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STATE OF SOVIET NEUROSURGERY AND ITS DEVELOPMENTAL PROSPECTS

Moscow VOPROSY NEYROKHIRURGII in Russian No 2, 1977 pp 3-10

[Article by A. G. Safonov]

[Text] The Communist Party and Soviet government constantly demonstrate great attention to and concern for the health of the Soviet people. "Among the social tasks facing us," CPSU Central Committee General Secretary L.I. Brezhnev pointed out at the XXV CPSU Congress, "there is none more important than the concern for the health of the Soviet people." During the years of Soviet government, a great deal has been done to establish and develop public health and medicine. The successes of Soviet public health have been made possible due to the vast socio-economic re-organization which has taken place in Soviet society, and as a result of the achievements of Soviet science and its close association with practical application as well.

The scientifically formulated program outlined by the XXV CPSU Congress for the future building of communism heralds a new historical stage in the development of Soviet society.

The increased scope and complexity of tasks facing medical science and public health require significant improvement in the level of organization and management of the public health branch at all stages and in all sectors, and further perfection of preventive medicine and prophylactic medical examination systems.

Specialized services of medical care, including the neurosurgical service, have been called upon to solve extensive and complex problems.

At the II All-union Congress of Neurosurgeons which took place at the end of 1976, results of the course followed to the present time were summarized, the state and level of neurosurgical

services were evaluated, and methods for further development and perfection were established.

Neurosurgery, the establishment of which Academician N.N. Burdenko devoted great efforts and attention to in our country, is now completely established as a branch of Soviet science and public health. Particular attention was devoted to the development of Soviet neurosurgery during the Ninth Five-Year Plan in the area of strengthening the material-technical base and training of personnel and also in the development and active implementation of contemporary methods for diagnosis and treatment of neurosurgical diseases in neurosurgical institutions.

Extensive work has been accomplished to organize a network of major neurosurgical departments and centers, to expand the volume and improve the quality of out-patient care for the patient having a neurosurgical profile, and for the training of doctors, -- surgeons, traumatologists, and other specialists in the field of neurosurgery.

As a result of measures which have been effected, the volume has increased and the quality improved of neurosurgical services rendered to the Soviet populace at all stages.

The period past was characterized by a rapid growth in the number of neurosurgical hospitals. At present, neurosurgical and neuro-traumatological hospitals exist in practically all republican, kray, oblast and major industrial centers, hospitals having more than 13,000 beds at their disposal. The majority of the neurosurgical centers are capable of resolving the tasks facing them considering modern scientific and technological achievements.

During the past five years, considerable attention has been devoted to and successes achieved in the perfecting of organizational systems for neurosurgical service.

Currently, the neurosurgical network in the USSR has an extremely well-balanced organization which is stipulated by the peculiarities of socialist public health.

Scientific research and basic organizational measures carried out in the country are coordinated by a head institution--the N.N. Burdenko Moscow Institute of Neurosurgery of the USSR Academy of Medical Sciences (director--corresponding member, Academy of Medical Sciences, USSR, Prof. A.N. Konovalov), to which is attached the All-Union Commission for Problem Research.

In the republics, there are major neurosurgical centers or departments which carry out organizational, methodological, and scientific work within the republic. As is known, the neurosurgical services of the Russian Federation and the Ukraine are headed by scientific-research institutes.

The neurosurgical service of the Russian Federation serves as a characteristic and striking example. In this republic during the years of the Ninth Five-Year Plan, the number of neurosurgical departments rose from 100 to 148, and the number of beds in them from 4962 to 7107. During this same period in the republic, 13 specialized spinal departments were opened for the restorative treatment of patients suffering trauma of the vertebral column and the spinal cord. This was a very important measure, a measure having not only great medical significance, but social, and economic significance as well. Unfortunately, insufficient attention is devoted to this important problem in certain republics, krays, and oblasts.

To perfect the organizational system for neurosurgical service in the RSFSR, a complete set of measures, each supplementing the other, was implemented. First of all, it must be noted that the organization based upon the major neurosurgical departments of inter-oblast neurosurgical centers (Irkutsk, Novosibirsk, Sverdlovsk, Kazan, Saratov, Gorkiy, Rostov and others) undoubtedly provided for the very rapid establishment and improved level of neurosurgical care in the ASSR, krays, and oblasts within the purview of the indicated centers, and for the overall improvement in the level of neurosurgical care rendered to the populace of the RSFSR.

Concurrently with the regional centers for neurosurgical care in the RSFSR, a series of highly-qualified specialized neurosurgical profile centers was established. These centers have specific tasks to develop very important particular problems of neurosurgery. For example, the Saratov and Irkutsk inter-oblast neurosurgical centers in collaboration with the collectives of other scientific-research institutions developed and are implementing on a wide scale a system for the comprehensive examination and treatment of patients having damage to the vertebral column and the spinal cord.

Here should be noted the extensive and purposeful work carried out by public health organizations and the RSFSR neurosurgical service for training in the field of neurosurgery of doctors, surgeons, neuropathologists, roentgenologists, etc.

In a majority of oblasts, krays, and ASSR's of this republic, specialists from inter-oblast and oblast neurosurgical centers systematically take planned trips to central regional hospitals, where, according to an established program, they undergo training with doctors in the diagnosis and treatment of trauma to the central and peripheral nervous system, patient analysis, demonstration operations, and the discussion of diagnostical, tactical, and treatment errors. As a result, the doctors of allied specialties acquire a more broad knowledge in the field of neurosurgery,



and as a consequence, each year the number of errors in diagnosis and treatment of neurosurgical patients is reduced.

The data cited, while far from fully characterizing neurosurgical service in the RSFSR, does permit the definite conclusion that the RSFSR has created a scientifically founded system for the organization of neurosurgical service and for the establishment of a network of institutions possessing this profile which will respond to the modern level of medical science development and the practical tasks of public health. Many sections of this service have stood the test of time.

We must note here the particular services in the development of this system of the collective from the A.L. Polenov Neurosurgical Scientific-Research Institute in Leningrad (director--professor V.M. Ygryumov).

We are far from implying that this system is completely perfected and is in no need of further development; however, we can, and have the moral right to consider it to be rational and effective at a given stage of development in public health and medicine. Moreover, neurosurgical services in many other republics have been organized according to this very same principle, primarily in the Ukrainian, Belorussian, Kazakh, and Uzbek SSR's. In the Ukrainian SSR, as in the Russian Federation, all neurosurgical service is headed in the scientific and organizational-methodological plan by the Kiev Scientific-Research Institute of Neurosurgery (director academician, USSR Academy of Medical Sciences, Prof. A.P. Romodanov).

Each republic has its own peculiarities. For example, two very important measures were effected in the Ukrainian SSR. The first was the organization at all institutions of higher learning in the republic of departments of neurosurgery or courses in this area given by senior lecturers, and the second measure was the establishment of a department for the rehabilitation of patients suffering diseases of and damage to the nervous system, a department based upon the Kiev Institute of Neurosurgery. This was the first and only department of the above profile. The organization of the indicated department undoubtedly played a positive role in the training of young doctors and of doctors possessing allied specialities in the field of neurosurgery and exerted significant influence upon the level of neurosurgical services rendered to the population of the republic.

Neurosurgical service is well organized in the Belorussian, Kazakh, Lithuanian SSR's, and in several other republics.

The organizational system for neurosurgical service and the principles for its establishment are essentially common in their premise in all republics in the Soviet Union. The service in all areas is headed by the Scientific-Organizational Center, which, in its activities, relies upon a network of oblast (inter-oblast) and inter-rayon neurosurgical centers. Only the volume and level differ.

The cited data bear witness to the fact, that firm foundations have been laid for the organizational system of neurosurgical service in our country. The task of the head neurosurgical institutions of the country and republics, and also of the chief neurosurgeons of the republics and oblasts is to thoroughly study existing experience in the field of neurosurgical service organizational systems, draw conclusions, carry out thorough analyses, and to implement necessary corrective measures. In conjunction with the systems for organization and establishment of a network of neurosurgical institutions, the problem of scientifically founded developmental norms for this service arises.

At the present time, throughout the USSR, the overall provision for the population of neurosurgical beds is 0.58 for each 10,000 of the population. According to calculations of the Scientific-Research Institutes of Neurosurgery in Leningrad and Kiev, to satisfy the optimum requirement for neurosurgical beds, a norm of 1.3--1.4 beds per 10,000 population must be established. In addition to this, based on calculations made by personnel of the Donetsk oblast neurosurgical service, a greater number of neurosurgical beds per 10,000 people is required for the Donbass.

Thus, the crux of the matter is the development not only of a scientifically based, but differential norm as well for given industrial-economic zones and agricultural oblasts.

Based upon research conducted in individual republics, krays, and oblasts, a certain number of neurosurgical profile patients receive treatment not in specialized departments and centers, but are hospitalized in surgical, traumatological, neurological, and other hospitals, where they do not receive the entire requisite program of examination and treatment. Thus, the question is not generally one of increasing the number of neurosurgical beds, but the re-profiling of a part of the bed resources, which in fact is occupied by neurosurgical patients. This is one of the most immediate tasks facing public health organizations and chief neurosurgeons in the republics, krays, and oblasts.

In addition to this, serious deficiencies exist in the volume and level of neurosurgical care provided.

It should be noted that a certain irregularity exists in the development of neurosurgery in the union republics, particularly in

the organization of neurosurgical care, which differ little from one another in the development of the public health base. For example, in the Trans-Caucasus republics, where good neurosurgical care exists in Armenia and is satisfactory in Georgia, but also in the industrially developed republic of Azerbaydzhan, the state of neurosurgical care obviously does not answer existing requirements. In a number of areas, underequipped neurosurgical departments are being organized to this day, in which the proper conditions for requisite examination and treatment of patients are lacking.

A vital requirement of today is making neurosurgical and above all, neurotraumatological care accessible to the rural populace. In the RSFSR, Ukraine, and a number of other republics, initiative has been demonstrated in the creation of a network of inter-rayon neurosurgical departments based upon major central rayon hospitals. And while this question requires further study, and the organization of inter-rayon departments must be approached with caution, so as not to dissipate personnel and resources, this initiative under specific conditions warrants a certain amount of attention. To make neurosurgical care accessible to the rural population, we must first of all train rural doctors and surgeons, traumatologists, neurologists, etc., in the field of diagnostics and early identification of neurosurgical patients and expeditious designation of those patients for treatment at a specialized neurosurgical department of the oblast or major industrial city.

Expansion of the network of neurosurgical hospitals, training of personnel, and equipping with modern medical equipment has enabled the volume to be increased and quality improved significantly in the area of neurosurgical care rendered to the population.

Overall, during the period, 1971--1975, 856,000 patients, of which 227,000 underwent surgery, were hospitalized in neurosurgical hospitals. In addition, a certain increase in the percent of neurotraumatological patients compared to all hospital patients can be noted.

Thus, in 1975, as compared with 1971, the percent of hospitalized patients with neurotrauma increased somewhat, while at the same time, the percent of patients with brain tumors and other "neurosurgical" diseases gradually is decreasing.

Extremely important as well are the qualitative indicators for the operation of neurosurgical hospitals. General surgery activity constitutes 29--30%, surgical activity with disease of the central nervous system--33--34%, with trauma to the central nervous system, --26--27%, with trauma to the peripheral nervous system--60--70%. In addition, such indicators as general and post-operative lethality in all forms of neurosurgical pathology, and also brain tumors, vascular diseases, and consequences of inflammatory diseases have a tendency toward reduction. Post-

operative lethality under conditions of acute trauma to the central nervous system during recent years is being maintained at approximately the same level.

Considering that a still significant number of neurosurgical and especially neurotraumatological profile patients are being hospitalized in non-specialized institutions, the problem continues to be one of training doctors, surgeons, traumatologists, neurologists, etc., in the field of neurosurgery.

The strategy and tactics of creating major neurosurgical centers has proven to be correct; centers where expensive specialized beds, complicated medical equipment, and highly qualified specialists can be utilized more rationally and efficiently.

Consequently, we must, in the future, devote particular attention to the specialized neurosurgical centers, to develop, strengthen, and consolidate that which is functioning now, and with consideration given the training of personnel and preparation of the material-technological base, to organize new areas. But here a particularly exacting and strict approach must be demonstrated, bearing in mind the solution of chiefly qualitative questions.

Pediatric neurosurgery still demands considerable attention.

At the present time, there are seven specialized pediatric departments of 250 beds in the country. In addition, in 13 oblast hospitals, a fixed number of beds have been allocated for children in neurosurgical departments. Development of specialized pediatric neurosurgical care was substantially influenced by the establishment in 1973 of a course in pediatric neurosurgery at the Central Institute for Qualification of Doctors, a course which is not only the basis for specialization of doctors for a given division of neurosurgery, but at the same time as a methodological center for this developing branch of central nervous system surgery.

However, this is only a beginning. According to preliminary calculations, a series of regional (inter-oblast) neurosurgical centers must be established to provide specialized care to children.

Despite the significant successes cited in the development of Soviet neurosurgery, substantial deficiencies still exist in the organizational system, volume, and nature of providing neurosurgical care in a number of republics, krais, and oblasts.

It is mandatory that care be improved for the patient with damage to the vertebral column and spinal cord both in the surgical and orthopedic plan as well as in the organizational plan for institutions for restorative treatment and social rehabilitation.

New successes were attained in the field of cerebrovascular pathology. Anatomical and physiological approaches were developed for cases which were earlier considered to be inoperable which involved arteriovenous aneurysms of the deep cerebral sections. At present, patients with these aneurysms are successfully undergoing surgery.

Microsurgical technique has received ever greater application in operations for vascular damage to the brain. The utilization of the microsurgical technique, the operation microscope, and the application of neurophysiological and anesthesiological achievements resulted in improved efficiency of surgical intervention involving arterial and arteriovenous aneurysms and to reduce post-operative lethality considerably.

During recent years, the method of endovascular surgery developed at the N.N. Burdenko Institute of Neurosurgery, USSR Academy of Medical Sciences by Doctor of Medical Sciences, F.S. Serbiyenko has undergone further perfection and has been implemented in the country's leading neurosurgical institutions. He also has practically resolved the problem of treating carotido-cavernous anastomoses, and the application of this methodology has been begun in the treatment of inoperable arteriovenous and arterial aneurysms.

Methods have been further developed for conservative therapy of patients with ischemic cerebral damage, particularly hyperbaric oxygenation.

Close attention of several scientific collectives was focussed upon one of the most difficult problems of modern neurosurgery--the treatment of patients with intracerebral glial tumors, the most common cerebral tumor.

During the past five-year plan, new methods for intra-operational diagnosis were developed and incorporated into clinical practice, and methods for surgical and comprehensive treatment of glioma were perfected.

Significant success was achieved in the treatment of patients with extracerebral tumors in locations with difficult access. Employment of the microsurgical technique permitted, under conditions of increased operation efficiency, the reduction of post-operative lethality in many tumor diseases.

Development of anesthesiological support methods for operations led to an improvement in operation results in cases involving tumoral damage to the brain, and improved operation efficiency as well as expanded indicators for intervention.

Definite successes were achieved in the treatment of patients having traumatic damage to the central nervous system.

Implementation of modern diagnostical methodologies in neurosurgical hospitals (various modifications of angiography, echoencephalography, electroencephalography, reo-encephalography, etc.) provided for a fuller study of the clinical aspects of post-trauma complications (intracranial hematoma and concussive basal foci) and the development of indicators for surgical intervention and thereby facilitate improvement of patient treatment results.

Of particular importance is the problem of rehabilitating patients who have sustained damage by accident or who have undergone surgery of the central nervous system.

Currently, scientific bases are being developed in neurosurgical institutes and clinics for rehabilitation, and methods for restorative treatment are being perfected. The task consists of insuring that the methods developed become property of neurosurgical clinics and restorative treatment centers, but of other institutions in which patients of a given profile are hospitalized as well.

Considerable attention is devoted to the research of various aspects of epilepsy. Research has been conducted in the development of local diagnosis of the deep epileptogenic foci and of various methods for surgical action upon the epileptogenic focus.

Study of catamnesis in patients having undergone surgery indicated the effectiveness of surgical intervention on the epileptogenic foci--a cessation of or reduction in frequency of attacks, and improved effectiveness of social and labor rehabilitation of patients undergoing surgery.

However, many questions of theory and practice in neurosurgery are far from being resolved, and demand close attention. In the current five-year plan, personnel and resources must be concentrated within the scientific-research institutions to solve the following primary problems.

1. Further more-detailed study of cerebral circulation and metabolism in various diseases and damage, which will provide for a more profound study of the causes of complications accompanying cerebral damage, for example, cerebral edema, and to prevent their occurrence and to employ more adequate methods of treatment and to prognosticate the outcome of the illness.

2. An in-depth study of the pathogenesis of critical cranio-cerebral trauma, the perfection of recognition methods for the characteristics of cerebral damage as the result of trauma, and the treatment of these damages.

3. Broader use of the microsurgical technique in operations for tumoral and vascular damage to the brain. Microsurgery is opening new horizons also in the restorative treatment for trauma damage to the peripheral nerves.

4. Perfection of endobasal intervention methods for the purpose of improving the results of cerebral vascular damage treatment as well as a more detailed study of cerebral circulation.

5. Expansion of a detailed scientific-research program for the restorative treatment of patients with diseases and damage affecting the peripheral nervous system.

6. Continuation of further research in identifying possibilities for the application in neurosurgery of cryodestruction, ultra sound, powerful directed magnetic fields, lasers, etc.

A broader and more rapid differential implementation of the achievements of neurosurgery and other sciences. A series of most complex methods requiring special equipment must be assigned the highest priority for introduction in the major and well-equipped neurosurgical clinics. Microsurgery for vascular and some tumoral diseases of the nervous system must be classified as these methods first of all.

Intra-operational methods for tumor location, location of necrosis foci and of certain other focal damage with the aid of radiometry, ultra sound echo location, etc.

Obligatory is the more effective exchange of experience in neurosurgical application of various methods of reanimation therapy, anesthesiological support for operations, etc.

Soviet neurosurgery has vast experience at its disposal, experience acquired since the first days of activity by the founder of Soviet neurosurgery, academician N.N. Burdenko, the 100th anniversary of whom was recently marked by our country's medical community. At present, our domestic neurosurgery is in a stage of growth, and the task entails not only quantitative growth, but chiefly manifold improvement in the quality of this form of specialized medical care and the efficiency of scientific research. During the Tenth Five-Year Plan, neurosurgery, as is apparent from the plans outlined in all republics, will develop at a more accelerated rate. The task of public health organizations, chief neurosurgeons and the entire neurosurgical community is to establish a daily, active control over the development of the material-technological base for neurosurgical services, over the training of personnel and the most expeditious implementation of the achievements of medical science and technology.

The rapid development of medical science and technology and the broad implementation of scientific achievements require educated and qualified management of this branch. Under contemporary conditions, this can be effected only by a highly qualified specialist who is capable of scientifically based organization and management. Greater demands are levied upon the chief surgeons of republics, krays, and oblasts, and upon the directors of specialized services as well, inasmuch as they must be not only highly qualified specialists in their own fields, but must be very familiar with allied sectors of medicine, and to be capable of managing a branch.

There is no doubt that Soviet neurosurgeons, inspired by the historical decisions of the XXV CPSU Congress, will carry out with honor those tasks standing before them.

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## FORENSIC PSYCHIATRY

### COMPULSORY TREATMENT OF THE MENTALLY ILL

Moscow CHELOVEK I ZAKON in Russian No 3, 1977 pp 17-25

[Article by V. Strelkov: "The Court's Decision: Commit for Treatment"]

[Text] An agitated visitor entered our editorial office. "Our bookkeeper K. has stolen tens of thousands of rubles," he said. "Despite the large amounts he embezzled, he wasn't imprisoned but sent away for treatment. They said he was not responsible for his actions. And now K. is in a psychiatric hospital. But we remember him as a perfectly normal person! And he carried out his embezzlements with such clever machinations that the auditors were not able to uncover them for a long time. What's going on? He's a criminal but he's not receiving his punishment?"

Having found out where K. is located, I went to the Moscow Psychoneurological Clinic and Hospital No 1, imeni P. I. Kashchenko. The hospital's chief physician Professor V. M. Morkovkin, Doctor of Medical Sciences, listened to me attentively.

"Patient K.?" he asked. "A bookkeeper? I remember. He entered here with a diagnosis of schizophrenia. He is undergoing compulsory treatment. What purpose would be served by convicting him and depriving him of his freedom, if he is mentally ill? It is impossible to judge him, but he does require treatment. Your visitor was misled by the fact that the bookkeeper behaved like a normal person. And this is reasonable, because in the majority of cases, only doctors are able to determine the presence and nature of mental disorder. People unacquainted with psychiatry will sometimes notice very little, although they may work for years side by side with a deranged person."

A common notion about lack of legal responsibility persists: a madman runs along the street, seeing and hearing no one and sweeping everything out of his path. And it is only such people, it is said, who are not responsible. In actual fact everything is much more complicated. The actions of sick persons may be sufficiently controlled outwardly. And most frequent of all, a mental disorder will not manifest itself at all. Such "quiet ones" are the most dangerous. They are capable of carrying out embezzlements of large

amounts, of armed robbery, murder and rape. And so the bookkeeper K. had long been suffering from schizophrenia and he embezzled money ... in order to seize the planet Mars and to declare himself its ruler.

As a rule, lunatics who have committed socially dangerous acts undergo compulsory treatment.

The Soviet legal code severely punishes crimes against our social or governmental order, against the socialist economic system, against socialist property, against the individual, and against the political, labor, property, and other rights of citizens, as well as other socially dangerous deeds affecting the socialist order. But what if a person, owing to his deranged condition, cannot take account of his own actions or cannot control them?

Article 11 of the Fundamental Criminal Code of the USSR and of the union republics and analogous articles in the criminal legal codes of all the union republics have established that a person who is not responsible while committing a socially dangerous act, that is, who is unable to take account of his own actions or to control them as a result of chronic mental disease, temporary derangement of his psychic functions, feeble-mindedness, or some other disorder, such a person is not subject to criminal prosecution. At the direction of the court such a person may be subjected to compulsory measures of a medical nature. The law also provides for a situation in which a person has committed a crime in a responsible state of mind but has begun to suffer from mental disease prior to sentencing by a court, which condition deprives him of the possibility of taking account of his own actions or controlling them. Such a person is not liable to punishment, and at the direction of the court he may be subjected to compulsory measures of a medical nature; and after his recovery, he will be liable to punishment.

"As you see," continued Valentin Mikhaylovich Morkovkin, "lack of legal responsibility refers to the person's mental condition at the time he commits socially dangerous acts. For example, the psyche of a patient suffering from schizophrenia in a sense bifurcates. The Greek word 'schizophrenia' signifies 'splitting of the soul.' As a rule, such sick persons are unsociable, suspicious, hostile and malicious toward others, and egocentric. The paranoid variety is most dangerous when persistent delirium is manifest. When the delirium affects relationships, it seems to sick persons that everything around has begun to relate to them in a negative manner. When the delirium produces persecution mania, they imagine they are surrounded by enemies, persons sent by someone, that someone is eavesdropping on their conversations and watching them closely. Under the influence of delirium sick people are capable of attacking others, of committing murders."

In order that the judicial organs might be able to decide whether they are dealing with a criminal or with a person not legally responsible as well as other questions, they are aided by expert forensic psychiatric opinion, which is under the supervision of the health service organs in our country. Such expert appraisal is carried out in response to a decree by the investigator, the prosecutor, the office of inquiry, to a decision by the court and

to a decision (decree) promulgated personally by the judge during the course of making a specific charge or during pretrial procedures in preparation for a civil case. And here it is particularly important to note that the expert in our country is independent in his judgments from the investigative organs. Besides this, the participation of a defense lawyer is mandatory in cases involving persons who have committed socially dangerous acts in a deranged state, and also those persons who have become mentally ill after they committed their crime. In this situation the defense lawyer is allowed to participate in the case from the moment the fact of mental illness is established.

... In a building of one story, standing apart from the hospital wards, we were met by V. K. Kosyrev, director of the outpatient department for forensic psychiatry.

"Commissions of experts work in this building," he said. "Our hospital conducts every kind of forensic psychiatric appraisal: in the hospital, outpatient, in the courts, for investigators; it carries out appraisals posthumously and when the subject is not available. When necessary, outpatient commissions travel to investigative isolation wards and to places of incarceration."

A great variety of reasons can be the basis for directing the accused, the convicted, a suspect, victim, or witness to undergo forensic psychiatric appraisal. When doubt arises concerning the mental health of such a person because of his unusual behavior or his absurd explanations and testimony regarding a case and so on, such a directive is mandatory. A petition requesting such an examination can be initiated by the suspect, the accused, the convicted themselves, by his defense lawyer, and also by the victim, the civil prosecutor and the civil defender or their representatives.

We enter one of the consulting rooms. Here in a spacious room a commission consisting of three members is in session. The chairman of the commission is K. A. Ovchinnikova, the member is I. S. Guseva, and the reporting doctor, Z. I. Lyapidus.

Materials are being examined on subject V., a man beyond middle age who makes himself appear younger. Action had been brought against him under Article 224, Paragraph 2, of the RSFSR Criminal Code for inducing a minor to use narcotic substances. Two girls, the victims of this crime, were brought to the hospital from V.'s apartment with symptoms of large overdoses.

But was this a crime or is V. mentally ill?

The reporting doctor Z. I. Lyapidus provided the commission with detailed data concerning the life and behavior of the subject from earliest childhood.

Symptoms of mental illness appeared a few years ago. A psychiatrist recommended that he be committed for treatment, but V.'s mother and he himself

refused to do this. But afterwards V. unexpectedly attacked a woman in a side street and took her purse. At that time he was recognized as not legally responsible. The administration and the collective of the plant where V. worked requested convincingly that he not be committed for compulsory treatment, because V. was considered a good production worker and comrade. They promised to look after his outpatient treatment.

The fact of the matter is that, according to Part 4, Article 60, of the RSFSR Criminal Code and similar articles in the criminal codes of the other union republics, if the court does not deem it necessary to subject a mentally ill person to compulsory measures of a medical nature, and likewise in a case where the application of such measures is terminated, the court can place him in the care of relatives or guardians under obligatory medical supervision. The court did not require V. to undergo compulsory treatment. But ... soon all the promises were forgotten. V. ceased to visit the rayon psychiatrist and began to abuse alcohol. The disease continued to develop-- and a new, socially dangerous act was committed: V. somewhere obtained a medication that contains a powerful narcotic and "treated" the two girls to it.

A mentally healthy person would be deprived of his freedom for a term of up to 10 years for such a crime. But a person mentally ill is not a criminal and must not be punished. The members of the commission consulted with one another and drew up a statement in which they indicated their diagnosis: schizophrenia.

"All these materials together with the statement of appraisal will be transmitted to the court," V. K. Kosyrev explained. "As you see, V. represents a danger to those around him and to himself. Therefore he must be separated from society and subjected to a course of treatment. But neither the doctors nor the investigator nor the prosecutor are able to commit a mentally ill person for compulsory treatment. Only the court can do this. In addition, the court's examination of such a case proceeds strictly according to the procedural rules of the criminal code, with the mandatory participation of the prosecutor and the defense attorney. A people's judge or the chairman of the court has the right to order the person whose action is under examination to be summoned to a session of the court (naturally, if the nature of his illness does not prevent it)."

During the session of the court proofs are examined which establish or refute the commission by a given person of a socially dangerous act covered by the criminal code, the experts' conclusion regarding the mental condition of the accused is heard, and other factors are examined which have an essential bearing on resolving the question of applying compulsory measures of a medical nature. After the completion of the court's investigation, the court hears the prosecutor and the defense attorney. The court resolves the case with its decision, which is announced in a conference room.

In accordance with Article 58 of the RSFSR Criminal Code and similar articles in the criminal codes of the union republics, the court can apply compulsory measures of a medical nature: commitment to a psychiatric hospital

of the general type or to a hospital of the special type--with people who have committed socially dangerous acts while not being legally responsible, or who have committed such acts in a legally responsible state but who have become mentally ill prior to sentencing or while serving a sentence, so that they are unable to take account of their actions or to control them. The court selects the type of compulsory measure in accordance with the individual's mental illness and the nature and degree of social danger represented by his action. Persons committed to psychiatric hospitals of the special type are confined in conditions of intensive supervision. This provides the possibility of successfully isolating socially dangerous sick people from society and of eliminating the possibility of their committing a new, socially dangerous act.

"In addition," V. K. Kosyrev said, "any psychoneurological institute, dispensary, and psychiatric hospital is able to carry out forensic psychiatric appraisals. In major hospitals such as ours, special sections for expert opinion have been created."

In our country management of forensic psychiatric appraisal and its control is implemented by the ministries of health in the union and autonomous republics, by the kray, oblast, and city health divisions through the republic, kray, oblast, and city psychiatrists. But the USSR Ministry of Health carries out methodological and scientific management through the Central Scientific Research Institute for Forensic Psychiatry imeni Professor V. P. Serbskiy. There many well-known research psychiatrists work, such as Professor G. V. Morozov, a corresponding member of the USSR Academy of Medical Sciences, Professor E. A. Kostandov, D. P. Lunts, and others. The institute works out scientific elaborations of the problems of forensic psychiatry, generalizes from experience gained in this area, and conducts other important scientific work. In especially complex cases the institute is entrusted with conducting psychiatric appraisals.

"But now I would like to be acquainted with the manner in which compulsory treatment is carried out," I said to G. P. Kaplin, deputy to the chief physician of the Hospital imeni P. I. Kashchenko.

"Of course," he said. "The basic treatment is complex. Medicinal preparations, and physiotherapeutic methods, and work therapy all enter into it, and much else."

Together with G. P. Kaplin I entered one of the hospital wards. The patients here are receiving the most varied treatments. Here is a consulting room where they treat with electric shocks, in another, with mineral and radon baths. In others they utilize water treatments, oxygen, the inhalation of medicinal substances and so on.

"We attribute very great importance to work treatment--work therapy," G. P. Kaplin said.

We walked around the hospital's grounds. To the right and left there were greenhouses and hotbeds, where vegetables are grown for the hospital. Behind the glass walls people in pajamas were visible: patients were zealously caring for the tomatoes, cucumbers, onions and lettuce. All of this fresh greenery will end up on their own dinner table.

"And here," Gennadiy Petrovich indicated a two-story building, "are the therapeutic production workshops. Don't be surprised if you see a person sleeping at his worktable or loafing in one of the shops. No one is forced to work here, where uncomplicated jobs are completed 'with gusto.' This is not at all ordinary production with specified regulations, discipline, and effort to fulfill a plan. Our production is only therapeutic, although the patients receive money for their work."

On some machines elegant New Year's trees were being made, in the shop next door slippers were being sewn, in the next location electric calculator components ordered by a plant were being produced. Ordinary patients and those who were undergoing compulsory treatment were working side by side.

"Those undergoing compulsory treatment are fully maintained by the state," said Gennadiy Petrovich. "And nothing is withheld from their pension. More than this, patients of this sort even earn money in the therapeutic production workshops (although not a large sum)."

We entered a large room. A multitude of pictures were on the walls. At first glance, the majority of them were creations of painters working in the abstract: piles of cubes and spheres, twisting fantastic monstrosities, chaotic explosions of color. All these paintings were done by patients. They reflect their illusions and hallucinations during periods when their sicknesses were acute. Some of the paintings were technically irreproachable.

"This one," Gennadiy Petrovich indicated one of them, "was painted by patient B., an able artist. It is true that he is being treated here in the ordinary and not in the compulsory manner. Certain foreigners literally hunt for his pictures done in states of delirium, and they offer B.'s relatives large sums of money for them. They think that it is precisely in states of delirium that the essence of the artist is expressed, his creative originality, some sort of 'subconscious genius.' Paintings done by B. in a normal state are less attractive to them...."

Any patient who wants to occupy himself with creativity can enter this room. Available to him are paints, which the hospital purchases, canvases, paper, plasticine, and plaster. Occupation with artistic creation not only helps in the successful treatment of the patients, but it provides an opportunity to observe the course of their diseases through these sketches and pictures; frequently the pictures transmit the inner state of the patient with considerable accuracy.

... The next day I was present at an unusual concert. Singers, an ensemble of electric musical instruments, dramatic readers, and dancers performed. The concert took place in the Fifth Psychoneurological Hospital, built about 70 years ago in Podmoskov'ye. A number of the patients undergoing compulsory treatment participated in this talent show.

Vsevolod Petrovich Podrezov, chief physician at the hospital, pointed out one of them:

"That's Yuriy P.," he said softly. "Formerly he worked as an engineer in a scientific research institute. He was caught stealing equipment from a laboratory. He was suffering from a delirious belief that he was an inventor; at home Yuriy P. was constructing a laboratory with this equipment, from which he intended to broadcast his ideas. And that one, in the grey suit, is Oleg V., a former lathe operator. Within his collective he was timid, shy, and industrious. No 'oddities' were even noticed in his behavior, aside from an excessive concern for his health, a fear of being infected by some disease. When he used urban transportation services he would not take hold of handrails, fearing that someone might have sneezed on them. All this time he was developing schizophrenia. In a moment of acute psychosis he tried to kill his wife with a wrench, then jumped from the eighth story of a building and broke two ribs. Now we can say that he is all right. Soon we will place before the court the question of discontinuing Oleg V.'s compulsory treatment. Next to him is Boris S. He was studying in the fourth course at an institute. He was preoccupied with building radios. He was known as an 'odd ball' among his comrades. And suddenly, seemingly for no reason at all, he splashed an acid solution in the face of a girl he knew."

The USSR Ministry of Health has confirmed a regulation concerning procedures in utilizing compulsory treatment and other measures of a medical nature in connection with the mentally ill who have committed socially dangerous acts. This regulation was jointly agreed to by the USSR Supreme Court, the USSR Procurator's Office, and the USSR Ministry of Internal Affairs. It states there that the administration of hospitals must place sick people entering compulsory treatment in therapeutic departments that correspond to their mental condition and that maintain conditions which avert the possibility of escape and other excesses on the part of the mentally ill. Naturally, corresponding measures have been taken in this hospital, too: special locks, tall walls around the exercise yards, constant observation of the behavior of the patients.... It must be said that the patients themselves, within their own collective, maintain strict discipline.

"It can't be otherwise," Yu. T. Kaganovich, director of the hospital's first department, told me. "Imagine that a patient with an acute psychosis escaped from his doctors' control. How much harm he would do! He could kill, commit sexual crimes, arson.... It's even difficult to imagine what might happen; after all, such a person is incapable of understanding his own actions and of controlling them. It is for this that such precautionary measures are taken."

It happens that the mental condition of a patient sometimes changes, and he can no longer be kept under compulsory treatment in the facilities provided by a hospital of a given type. Then the hospital administration goes to court with a representation recommending a change in the measures of a medical nature.

Such was the case, for example, with Nikolay M. He was undergoing compulsory treatment procedures in a hospital of the general type. But the disease became more acute; Nikolay M. began to attack the hospital's medical personnel, and he tried to kill an orderly. In accordance with the justified representation of the hospital administration the court changed the measures of a medical nature, and Nikolay M. was placed in a psychiatric hospital of the special type.

"However, the contrary process is more often the case," said V. P. Podrezov, "when those who are convalescing come to us from hospitals of the special type. For example, Svetlana P. was brought to us from there; she killed her husband a few years ago during her 'honeymoon': a 'voice ordered' her to do it. We have many other patients, whose compulsory treatment should soon come to an end."

Yes, here they do not reeducate nor do they punish, they only treat. Because here there are no criminals, only sick people. And no matter what socially dangerous act such a person may have committed, for the doctors, orderlies, and nurses he is a patient like all the rest in this medical institution. And the attitude toward him is attentive. Every doctor, every hospital worker struggles for his health just as stubbornly as they would for the health of any other person.

Compulsory treatment continues as long as the mental condition of the patient does not change and he continues to be dangerous to those around him and to himself. To this end, all who are undergoing compulsory treatment are reexamined at least once every 6 months by a commission of doctors, which specifies their mental condition and the possibility of placing before the court the question of changing or discontinuing compulsory measures of a medical nature. The court examines this question within 10 days after receipt of the hospital's conclusion. It is important to give attention to the fact that petitions about discontinuing or changing compulsory measures of a medical nature can be made by the patient's relatives and by other interested parties. The Procurator's Office has responsibility for overseeing the legality and the enactment of the court's decisions regarding compulsory treatment, and the health service organs control the timely and proper implementation of compulsory treatment.

In this way the application of compulsory measures of a medical nature to the mentally ill and their commitment to psychiatric hospitals is based on strict observation of socialist legality.

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## INDUSTRIAL MICROBIOLOGY

### LYSINE FEED CONCENTRATE

Riga SOVETSKAYA LATVIYA in Russian 12 Jun 77 p 2

[Article by S. Il'icheva]

[Text] There are 20 amino acids in nature. They are contained in the protein molecule and form long strands. There are more than 50 amino acid bases in each such molecule. Among them are essential ones, i.e., those that the body cannot synthesize and that have to be ingested in ready form.

Lysine is the most deficient amino acid in proteins of grains, which are the basis of cattle feed. On the whole in our country, the lysine shortage constitutes 70,000-80,000 tons annually.

For many years, scientists have been faced with the problem of developing the technology for industrial production of lysine in the form of a feed concentrate. In 1964, the first strain of bacterium, which synthesizes very much lysine as it multiplies, was discovered at the Institute of Biochemistry imeni A. N. Bakh, USSR Academy of Sciences. The start of research in the field of technical microbiology by scientists of the Institute of Microbiology imeni Avgust Kirkhenshteyn, Latvian Academy of Sciences, also dates back to approximately the same time. The problem was to make the bacterium synthesize more lysine. The Japanese made a breakthrough in this direction that is known to the entire world. They obtained a yield of 60 grams of lysine per liter nutrient medium in 3 days of growth of bacterial biomass.

Latvian scientists, who studied the fine biochemical processes of regulation of reproduction of the highly productive bacterial strains they developed, and having learned to control the process of bacterial synthesis, obtained 80 grams of lysine in the same time. This is the highest index achieved in worldwide practice. This is how our own highly effective and competitive process of microbiological production of lysine feed concentrate was developed.

This major project involving many years of work and many scientific teams of the country to test the biological action of the product has been nominated for the USSR State Prize. M. Ye. Beker, Doctor of Engineering Sciences, corresponding member of the Latvian Academy of Sciences and deputy director of the Institute of Microbiology that heads all research in the field of obtaining and studying lysine, tells us:

"Unlike the well-known foreign knowhow, we did not isolate lysine in the form of crystals from nutrient medium after fermentation. The staff of the laboratory of animal biochemistry of the Institute of Biology of our academy, headed by Prof A. Val'dman, proved that there are no admixtures deleterious to the animal organism in the medium in which lysine ferments (we produce it on molasses, a waste product of the sugar industry). For this reason, it is expedient not to isolate lysine in pure form, but to obtain it as a dry feed concentrate. Moreover, this concentrate has methionine-sparing properties, and methionine is another essential amino acid. In turn, the methionine-sparing properties determine the presence of a valuable biological substance, betaine, which passes into the product from the raw material during the fermentation process. In addition, there are many vitamins of the B group in the dry concentrate. All these substances increase the efficacy of the lysine concentrate by about 10%. It also has stabilizing properties with respect to vitamins.

Theory and technology of thermal dehydration of products of lysine fermentation, which we developed, has made it possible for the first time in worldwide practice to obtain a concentrated form of lysine feed. We studied and developed the specifications for culturing lysine-producing bacteria in a periodic and continuous mode.

Much has been done with regard to technical support of the fermentation process. In this regard, U. Viyestur, Candidate of Engineering Sciences, who heads one of our laboratories, deserves much credit.

The cost of lysine is 50% less in concentrate form than the cost of the crystalline form, and 30% less capital investment is required to organize production of the former. And since there are so many valuable substances in the lysine concentrate, this prompted us to develop premixes with this concentrate as the base. After all, a plant with a capacity of 5,000 tons of concentrate production per year concurrently obtains concomitant valuable substances, premix components, worth 2-3 million rubles.

Latvia's and the nation's first large experimental production plant in Līvāni, which was built in 1971, has already exceeded its designed capability by 70% and for the second year is producing premixes for the animal industry. The premix form is not hygroscopic, unlike the primary concentrate, and this makes it easier to use in the mixed feed industry.

The effectiveness of lysine feed products in the animal industry has been tested in 20 specialized institutes on different species of livestock and poultry. It has been established that the lysine feed concentrate is particularly effective in low-protein and monograin diets. Addition of 1 to 4 kg lysine per ton feed increases mean daily weight gain of pigs by 30-50%, with a 15-20% savings on feed and protein. A better quality of pork is also observed. Milk substitutes can be made with the concentrate as the base, in order to lower milk outlay in fattening pigs and calves.

The Obol'sk (Belorussia) and Charentsavan (Armenia) plants have begun to produce lysine feed concentrate. The opening of new plants will make it possible to obtain about 20,000 tons of lysine per year toward the end of the 10th Five-Year Plan, and to save grain worth 250 million rubles annually. True, this is far from meeting the nation's demands, and the lysine feed concentrate industry must continue to develop.

As for the main results of our work in collaboration with biologists, employees of the Līvāny Plant and staff of the Latvian Scientific Research Institute of Animal Husbandry and Veterinary Science, the developed scientific bases for obtaining feed lysine are the result of original research in the field of engineering [technical] microbiology, biochemistry of microorganisms and animals. A new, highly-effective and economically justified source of lysine for feed purposes has been developed. The scientific data have been verified comprehensively under experimental production conditions, they have been adopted in the national economy of Latvian SSR, and they have been included in the basis of multiton production of lysine feed for the needs of the entire nation, at the planning stages and under construction.

But our research does not end here. The institute's laboratories must continue breeding more productive bacterial strains and investigate the mechanisms of regulation of biosynthesis.

We plan to do much to upgrade the equipment used in biosynthesis, including the use of an electronic computer to control the fermentation process. We are searching for new areas of application of lysine, in particular in plant growing. The staff of Rostov University has already proven that lysine is an attractant of soil pests of seeds. In the future, it will be possible to use amino acid preparations that are harmless to plants and soil, instead of toxic chemicals."

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## PHARMACOLOGY

### PROBLEMS IN PRODUCTION OF CERTAIN ANTIVIRAL PREPARATIONS

Moscow VESTNIK AKADEMII MEDITSINSKIKH NAUK SSSR in Russian No 5, 1977 pp 11-16

[Article by V.P. Grachev, L.L. Mironova, S.G. Drozdov, L.I. Avdeyeva, V.D. Popova, A.N. Mustafina, N.M. Ral'f, G.A. Alpatova, and A.V. Tyufanov:  
"Problems Encountered in the Production of Certain Antiviral Preparations"  
USSR Academy of Medical Sciences Institute of Poliomyelitis and Viral Encephalitis, Moscow]

[Text] The achievements of medical virusology during the past decade have made it possible to successfully resolve an entire series of practical problems associated with vaccinoprophylaxis of infectious diseases.

The USSR Academy of Medical Sciences Institute of Poliomyelitis and Viral Encephalitis has made a significant contribution to the struggle to reduce viral illnesses. Resourceful scientific-theoretical research has provided for the creation of several types of antiviral preparations.

The experimental research in the development of safe and highly effective antiviral vaccines was based upon theoretical premises relating to questions of stability for genetic features in attenuated strains during the production process and the application of preparations and factors influencing the specified phenomenon, problems of the cellular substrate as a basic factor in the development of safe preparations, the optimization of conditions for cultivating cellular systems and attenuated viral strains, and also problems associated with the multistage biological control as a guarantee system for the manufacture of quality vaccines.

The experimental results obtained were utilized as basic points for the development of technological principles for the production of several antiviral vaccines. This primarily refers to the development of a peroral live vaccine against poliomyelitis from the Sabin strains (ZhVS), of which more than one billion doses have been produced. For just the period from 1965 through 1975, 217 series (46.6 thousand liters) of monovaccine type 1, 93 series (17.4 thousand liters) of monovaccine type 2, and 140 series (23.6 thousand liters) of monovaccine type 3 (tables 1-3) have been produced.

Analyzing the materials for production of ZhVS of all three immunological types the stability of the manufactured preparation can be discussed. This is related to, firstly, strict observance of the inoculation virus system: for approximately 9 years, we have utilized one and the same inoculation virus of types 1 and 2 (series ZhVS Nos 360, 362), representing the fifth passage from the patented Sabin strain, and type 3 (series No 587), which contains the attenuated virus of the third passage from the patented strain.

The use of the same inoculation viruses for the production of ZhVS, the thorough analysis of control test materials for all series produced during this period (primarily for neurovirulency), and also an absence of any feedback from practicing doctors who have used the given preparation over a period of several years is evidence that the stability of attenuated virus properties is dependent not so much upon its passage level from the patented strain (Boulger and Magrath 1973), as it is upon a thorough previous study of the inoculation virus obtained and the deviations of its properties from the patented strain.

Table 4 contains data relating to the study of residual neurovirulency of vaccines produced from the aforementioned inoculation viruses during experiments involving intracerebral infection of monkeys. As is apparent, during the period analyzed, no deviations whatsoever were noted from the patented strain. Concerning the vaccine of the poliomyelitis viral strain type 3, its unstable genetic character is common knowledge. For the period studied, (10 years), four series of the type 3 ZhVS were rejected. However, the frequency of rejection for series of the above-mentioned type preparation did not exceed the usual frequency for increasing neurovirulency of certain type 3 vaccine series.

Property stability of the poliomyelitis attenuated viral strain is dependent upon a number of different factors: incubation temperature of cellular cultures inoculated by the inoculation virus, standard conditions for cell cultivation in one and the same culture medium, and storage temperature for the inoculation viruses (V.P. Grachev, et al, 1975).

For increased preparation standardization, great significance was attached to an increased yield of cells from 1 gram of kidney tissue by means of trypsinization (table 5, L.L. Mironova, et al, 1975). If in 1965, the yield of viral preparations for types 1, 2, and 3 totaled 6.8, 6.3, and 7.1 liters respectively, then in 1974 it equalled 36.1, 48.7, and 37.5 liters. On the average, the virus yield from one pair of monkey kidneys increased from 6.7 to 40.7 liters, i.e., by a factor of six. At present, the ZhVS series produced by the USSR Academy of Medical Sciences Institute of Poliomyelitis and Encephalitis consists in all of 4-5 batches of an intermediate product compared to 20-30 batches combined in the series prior to perfection of manufacturing technology for the preparation (see tables 1-3). It must be emphasized, that at the same time, the volume of series vaccine increased from 140 to 160-200 liters. In addition, the virus titer was determined to be at the same level in several series, although in the majority of them,

its activity was increased. The increased volume of preparation series also provided for production standardization and the manufacture of a homogenous population of active virus equal to many millions of inoculation doses. Due to other factors, standardization of methodology used in the production of ZhVS must be emphasized. Their employment provides for the unified program for manufacturing many live antiviral vaccines.

One of the most important stages of production for live vaccines, including ZhVS, is the selection of the cellular substrate. It is now firmly established that not a single living mammal or bird tissue is absolutely reliable in the scheme of possible contamination by foreign viruses or other agents. In this respect, paramount significance is attached to the organization of the control-monitoring program measures, which include quarantine of the monkeys, examination of the cell cultures, and observance of the semifinished (intermediate) product and the finished preparation. Clinical observation of the monkeys, establishment of a tuberculin opthalmic test, sanitation of the monkeys with antibiotics, and pathologoanatomical monitoring at the time the kidneys are removed permits sick animals to be rejected. Mandatory observation (serological) makes it possible to use only those animals for production that do not possess antibodies against adenoviruses and OV 40 viruses. Thus, during the past 5 years, as a result of blood serum tests for 3700 monkeys, 145 (3.9 percent) were rejected due to the presence of antibodies to the virus specified.

The next stage insuring the safety of the vaccine is a thoroughly developed technological program for control/monitoring entailing the use of a series of sensitive testing methods in cell cultures and on laboratory animals. In an overwhelming majority of instances, foreign agents were discovered in noninfected cell cultures, the consequence of which was that not one of the 800 observed series of the ready preparation was rejected for contamination reasons.

Inasmuch as the safety of the vaccine basically is dependent upon the quality of the cellular substrate, further perfection of the ZhVS production technology was associated with the development of cell storage in liquid nitrogen until the conclusion of observation. Experimental research conducted in this area indicated that cell cultures derived from green marmoset kidneys were successfully stored for long terms (up to 3 years) utilizing cryoprotectors in liquid nitrogen with no change in the number of viable cells or in their prophylactic qualities and sensitivity to vaccine strains of the poliomyelitis virus. These properties were preserved with subsequent subfiltering (up to 3 passages) of restored cell cultures after storage in liquid nitrogen. Experimental ZhVS series produced in the subcultures did not differ from the usual serially produced preparations in any of these properties.

A second direction is the use of diploid cell cultures from green marmoset embryos, (V.P. Grachev, et al, 1972). Experiments conducted to study culture conditions for diploid cell strains from various green marmoset embryo organs, the determination of factors influencing this process, and the study of conditions for the multiplication of viral vaccine strains of poliomyelitis permit conclusions to be drawn concerning the prospects of utilizing

diploid cell strains obtained from green marmoset embryos for the manufacture of prophylactic preparations.

We obtained more than 30 inoculation cultures from various green marmoset embryonic organs, which can be considered diploid strains analogous to diploid strains of human origin. The confirmation expressed corroborates the morphological peculiarities of the cells studied, cultural properties, long-term preservation of primary features during the passage process, caryotype, and also the onset of the characteristic phase after the period of active proliferation.

It is particularly important to note the fact that in its sensitivity to the poliomyelitis viral vaccine strain, the diploid cell strain(s) studied by us which were obtained from monkey embryo kidneys under optimal conditions for cell proliferation and replication of the virus did not differ from the initial trypsinized culture (table 6).

The indicators we obtained exceed published data on the sensitivity of diploid strains obtained from the embryonic lungs of monkeys, rhesus macaques, green marmosets and chimpanzee lungs (Petricciani, et al, 1971; Roslin, et al, 1973; Helmke, et al, 1972). The diploid strains of cells obtained from different green marmoset embryo organs as a rule were less sensitive to the poliomyelitis vaccine strains. Only in the strain obtained from the green marmoset lung did the virus accumulate within the range of 7.1--7.2 BOE/ml.

From the virus cultivated in the diploid cells of the green marmoset embryo kidneys, we prepared several experimental series of ZhVS. Controlled research of the preparation series was conducted in accordance with the requirements of the World Health Organization (WHO, No 179, 1959), and indicated the absence of any differences between the new ZhVS series and the serial production preparations produced in the initial cell cultures from the green marmoset kidneys. However, to convert from experimental to large-scale serial production of antiviral preparations requires the resolution of certain extremely important problems (safety of the monkey diploid cell for humans, prevention of microplasm contamination, and differentiation by chromosomes in the caryological control of the diploid strain).

The problem of profit in the production of antiviral vaccines is of no little importance, particularly with respect to the use of imported raw materials and reagents. Therefore, those cell cultures from the green marmoset kidneys which for minor reasons could not be used for the production of ZhVS, served as a substrate for proliferation of viral vaccine strain (Rokborn) for carnivorous plague. The Rokborn (Rockborne) strain was adapted in advance for the above-mentioned culture during the course of 5-10 passages at a temperature of 34 degrees. Selection of the optimum adaptation conditions permitted the level of attenuation in the vaccine virus to be maintained, as well as the low reactivity and high effectiveness for immunization which are characteristic of the indicated strain (M.P. Chumakov, et al, 1974).

As a result of the research conducted, a dry live vaccine ("Vakchum"), of which more than 100 series have been produced to date. Use of the vaccine during the past 4 years has resulted in the complete eradication of carnivorous plague in many specialized fur-producing state animal farms.

In addition to the mentioned preparations, the institute produces a reagent, safe, and high-immunological vaccines against yellow fever (V.P. Grachev, 1974). A new technology was developed for this vaccine which employs as a substrate surviving chicken embryo tissue to proliferate the virus. Optimal parameters were chosen for proliferation of the virus, parameters dependent upon the composition of the supporting culture medium, survival conditions for the tissue, the multiplicity of infections, and incubation time. The new technology, which provides for the use of suspensions from chicken embryos, enables the manufacturing process for the vaccines to be simplified, and to significantly increase the virus yield from a single embryo.

In addition, a vaccine manufacturing technology was developed for yellow fever vaccines utilizing the embryos of the Japanese quail which were free from poultry leucoses, (O.G. Andzhaparidze, et al, 1971).

Data on the proliferation of yellow fever viral vaccines in the indicated substrate were compared with results obtained with chicken embryos (table 7).

Control of the vaccine against yellow fever is implemented in accordance with international requirements (Techm Rep. Ser. WHO, No 179, 1959), and is supplemented by a series of new tests relating to the checking of embryos for contamination by foreign agents (V.P. Grachov, 1975). The control system developed for the yellow fever vaccine was accepted in the testing of 47 series.

The data presented permits the conclusion, that the manufacture of standardized, effective, and safe antiviral vaccines is contingent upon a series of factors, above all the selection of an optimal production technology program which guarantees total preservation of the genetic properties of the initial patented strain in the vaccine, with use of an appropriate substrate for the proliferation of viruses, and for a reliable system of control for the preparation at all stages of its manufacture.

(1) Сведения о производстве живой полиомиелитной вакцины типа I					
(2) Год	(3) Число серий	(4) Среднее количество партий в одной серии	(5) Средний объем серии, л	(6) Средний титр вируса после тепловой обработки в присутствии MgCl <sub>2</sub> , lg БОЕ/мл	(7) № серия посевного вируса, использованного для приготовления вакцин
1965	20	21,8	148,9	7,2	234
1966	12	20,8	165,0	7,4	234
1967	13	19,6	168,9	7,4	234, 360
1968	22	20,5	171,2	7,3	360
1969	18	24,8	219,1	7,4	360
1970	19	21,3	200,7	7,4	360
1971	16	20,7	207,0	7,3	360
1972	20	12,3	181,8	7,4	360
1973	32	7,7	203,8	7,5	360
1974	37	5,6	208,8	7,5	360
1975	8	3,6	204,5	7,6	360

Table 1

[Key on following page]



Key:

1. Data on the production of live poliomyelitis vaccine, type 1
2. Year
3. Number of series
4. Average number of batches in one series
5. Average volume of series, in liters
6. Average viral titer following thermal processing with  $MgCl_2$ , 1 gram BOE/ml
7. Series number of inoculation virus utilized for vaccine preparation

(1) Сведения о производстве живой полиомиелитной вакцины типа 2					
(2) Год	(3) Число серий	(4) Среднее количество партий в одной серии	(5) Средний объем серии, л	(6) Средний титр вируса после тепловой обработки в присутствии $MgCl_2$ , lg БОЕ/мл	(7) № серии посевного вируса, использованного для приготовления вакцины
1965	16	19,6	133,9	7,3	233
1966	7	21,0	167,9	7,6	233
1967	9	21,7	179,3	7,6	362
1968	5	19,8	160,2	7,3	362
1969	10	25,6	194,5	7,5	362
1970	10	21,8	199,1	7,4	362
1971	1	28	166,7	7,1	362
1972	7	12,6	168,7	7,5	362
1973	11	8	212,9	7,5	362
1974	13	4,4	211,2	7,4	362
1975	4	3,5	162,3	7,6	362

Table 2

Key:

1. Data on the production of live poliomyelitis vaccine, type 2  
Remaining headings identical

(1) Сведения о производстве живой полиомиелитной вакцины типа 3					
(2) Год	(3) Число серий	(4) Среднее количество партий в одной серии	(5) Средний объем серии, л	(6) Средний титр вируса после тепловой обработки в присутствии $MgCl_2$ , lg БОЕ/мл	(7) № серии посевного вируса, использованного для приготовления вакцины
1965	19	20,1	143,1	7,4	232
1966	21	20,5	168,0	7,4	232
1967	8	17,0	169,5	7,5	232
1968	6	23,3	159,4	7,2	232
1969	9	23,8	201,8	7,6	381
1970	10	20,6	205,4	7,6	381, 232, 235
1971	15	21	195,0	7,3	231, 381, 587
1972	14	13,4	188,3	7,5	587
1973	9	8,1	205,4	7,6	587
1974	25	4,8	211,7	7,6	587
1975	4	4	197,4	7,8	587

Table 3

Key:

1. Data on the production of live poliomyelitis vaccine, type 3  
Remaining headings identical

(1) Результаты изучения остаточной  
нейровирулентности живых полиомиелитных вакцин  
в опытах на обезьянах

(2) № серии посевных вирусов	(3) Тип	(4) Число серии	(8) Количество обезьян				(6) с гистологически выраженным полиомиелитом в центральной нервной системе из числа исследованных
			(5) с клинически выраженным паралитическим полиомиелитом из числа зараженных				
			(7) абс.	%	абс.	%	
360	1	65	0/1073	0	22/1010	2,17	
362	2	68	0/537	0	8/481	1,7	
587	3	54	2/710	0,28	6/690	0,86	

Table 4

Key:

1. Results of study on residual neurovirulency of live poliomyelitis vaccines in tests on monkeys
2. Inoculation virus series number
3. Type
4. Number of series
5. with clinically expressed paralytic poliomyelitis (of number infected)
6. with histologically expressed poliomyelitis of the central nervous system (of number researched)
7. abs.
8. Number of monkeys

(1) Результаты трипсинизаций почек обезьян за последние 10 лет

(2) Год получения культур	(3) Число пар почек	(4) Вес тканей, г	(5) Всего клеток $\times 10^4$	(6) Число посажен- ных 1,5 л матрас- ных колб	(7) Средний выход кле- ток из 1 г ткани $\times$ $10^4$	(8) Средний выход кле- ток из одной пары почек $\times 10^4$	(9) Число матрасных колб из	
							(10) 1 г ткани в среднем	(11) одной пары почек в среднем
1965	1 655	18 736	974 272	37 740	52	588	2,0	23
1966	1 526	16 924	1 404 692	44 668	83	986	2,6	29
1967	972	9 961	876 490	26 073	90	901	2,7	27
1968	1 241	12 671	1 061 820	30 958	83	855	2,4	25
1969	1 542	13 900	1 289 619	39 887	92	836	2,9	26
1970	1 413	15 444	1 514 553	44 696	98	1 072	2,9	31
1971	1 159	12 028	1 597 878	41 757	133	1 378	3,4	36
1972	946	11 100	1 655 675	50 176	149	1 750	4,5	53
1973	683	8 097	1 549 297	52 048	191	2 268	6,4	76
1974	444	5 108	2 073 848	61 440	406	4 671	12,0	140
1975	133	1 485	593 988	18 924	400	5 257	12,7	167
Всего . . .	11 694	125 454	12 702 132	418 367				

Table 5

[Key on following page]

Key:

1. Results of trypsinization of monkey kidneys during the past 10 years
2. Year culture obtained
3. Number of kidney pairs
4. Weight of tissue (grams)
5. Total cells (times  $10^6$ )
6. Number of planted 1.5 liter separating flasks
7. Average yield of cells from 1 gram of tissue
8. Average yield of cells from 1 pair of kidneys
9. Number of (matrass) flasks from
10. 1 gram of tissue (average)
11. One pair of kidneys (average)

(1) Зависимость чувствительности к  
вирусу полиомиелита типа 1  
диплоидных клеток почек эмбрионов  
зеленых мартышек

(2) Уровень генерации клеток	(3) Титр, 1 БОЕ/мл
6	7,3
11	7,7
12	7,8
13	7,2
17	7,8
17	7,8
18	7,6
19	7,5
20	7,4
21	7,3
22	7,3
23	7,3
24	7,4
26	7,7
30	7,9
30	8,0
30	7,3
32	7,4
32	7,4

Table 6

Key:

1. Relationship of green marmoset embryo kidney diploid cells to the type 1 poliomyelitis virus
2. Cell generation level
3. Titer, 1 gram BOE/ml

- (1) Результаты титрований лиофилизированной вакцины против желтой лихорадки из штамма 17Д, изготовленной в эмбрионах японской перепелки

(2) № серии	(3) Титры, lg БОЕ/мл			
	(4) титр вируса в ампуле			средний титр вируса в серии (5)
	1	2	3	
1	5,2	5,0	5,1	5,1
2	4,9	4,3	4,5	4,6
3	5,0	4,8	4,9	4,9
4	4,8	5,1	4,8	4,9
5	4,9	4,8	4,8	4,8
6	5,5	5,4	5,6	5,5

Table 7

Key:

1. Results of tritration of lyophilized yellow fever vaccines from strain 17D, produced in Japanese quail embryos
2. Number of series
3. Titters, 1 gram BOE/ml
4. Virus titer in ampule
5. Average virus titer in series

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## PHYSIOLOGY

### MAN IN AN ARTIFICIAL BIOSPHERE--SUCCESSFUL COMPLETION OF AN IMPORTANT SCIENTIFIC EXPERIMENT

Moscow IZVESTIYA in Russian 27 May 77 p 4

[Article by Ye. Vostrukhov, special correspondent of IZVESTIYA, Krasnoyarsk, (reported over telephone)]

[Text] They live and worked on their "planet" for 4 months. For 120 days, circulation of matter in the man-made biosphere served as their source of air for breathing, water and food, as man controlled all processes of life support in accordance with a predetermined program.

This experiment, which was a continuation of many years of research, began on 25 January at the Institute of Physics imeni L. V. Kirenskiy, Siberian Department of the USSR Academy of Sciences. At 1900 hours, the doors were sealed and scientists M. Shilenko and G. Asin'yarov, with engineer N. Burgeyev, began their work in the experimental Bios-3 complex, assembled in a special bunker. It has the appearance, on the exterior, of a one-story apartment house with a flat roof. It is 126 square meters in size and has 315 cubic meters of space.

Such are the parameters of this "planet," which make it possible to create a closed ecological system within its steel shell, the "cast" of which are man and higher plants, as well as to organize the vital exchange of matter between them.

Research on development of closed ecological systems began at this institute soon after the memorable flight in space of Yu. Gagarin.

Man's penetration into space and exploration of distant planets raises the question of total "biological separation" of man from his cradle, earth. Supplies are one thing, but people will require living conditions comparable to those on earth in those cold chasms of space. This is why scientists, even now, are persistently searching for the means of developing self-supporting habitats that could become a cozy home, a miniature island off their native planet for earthlings.

The Bios-3 experiments are giving birth to one variant of such a space home. People and plants can successfully coexist under one roof for many months in a closed area. Rather comfortable conditions have been provided here for the crew. Each subject has his own private [sleeping] cabin. In the living quarters [compartment] there is a cozy kitchen with electric hot plate and refrigerator of ZIL [Plant imeni Lenin], shower room and a lounge. There is a library, radio and television. The ventilation system constantly delivers fresh air into the living quarters from a plant that produces oxygen from phytotrons. They take up half the area of the complex. In one of them, there is a fragrant, rich and lush garden flooded with bright light from xenon lamps. Carrots and radishes, cabbage and cucumbers, onions and southern chufa [Cyperus esculentus] with remarkable nutritional qualities, the tubers of which are rich in vegetable oils and are used as food, are cultivated here in steel trays on claudite [clay filler] by the hydroponics method.

In the middle compartment, the beholder is greeted by a cheerful wheat field. And there is not just one, but a whole dozen of such fields. These fields are amazing: in some of them, the friendly seedlings are just turning green, in others the plants have already sprouted tubules, while others yet have full and heavy spikes; there is a green aging [?] conveyer in operation in the phytotron. A harvest is reaped here every 9 days. And what a harvest! Up to 1.3 kg grain is obtained per square meter in 63 days, which corresponds to 130 centers per hectare! But this required development of special agrotechnical procedures (wheat grows on the trays ... in air, while the stalks hold on to the plastic laths) and breeding a special short-stalked variety.

"In our experiments, chlorella was man's first 'partner'," we were told by the head of the laboratory of controlled biosynthesis, G. Lisovskiy, Doctor of Biological Sciences. "It reliably supplied the subjects with oxygen and water, but for the time being it is difficult to use these protein-rich and rapidly maturing algae for balanced nutrition. For this reason, we included a third element in the system, higher plants."

Many years of research resulted in selection of the most promising of such plants and development of methods of raising them.

The experiments of prior years revealed that the rate of circulation of matter in systems can be increased by 1000 times, as compared to natural conditions. Numerous experiments, including those with the Bios-3 complex, continued to adjust the biological elements to man and one another and to refine the scheme of mass exchange.

... There is a daily schedule for the subjects to follow, just like for cosmonauts. Their work day begins with mandatory workout. Then they wash and dress and have breakfast. And then comes intensive work. Each day some of the time was spent on work in the phytotrons: adjustment of the solution in the hydroponic system, gathering and planting vegetables and wheat, and grinding the sheaves. The compartments also had to be cleaned. Mass exchange was tested daily.

It must be stressed that a considerable time was reserved for research on a broad program. But people rested in their free time: they read, looked at television, listened to radio, shared news with on-duty operators and physicians (over a communication system using a microphone). After all, this experiment did not pursue the goal of psychologically isolating the subjects from the world. They could always see their colleagues through wide portholes.

They wrote home regularly; this too was not frowned upon according to the program. Incidentally, in these months Nikolay and Gennadiy improved their cooking skills appreciably; they prepared their own food. The kitchen chores increased in particular after the two men were left by themselves; as planned, agronomist Mariya Shilenko left the system after organizing the first stage of the green conveyer. But any homemaker would envy their cooking: diverse dishes made of vegetables, fragrant bread made of wheat flour that they ground themselves, pancakes, cookies and fragrant rolls. The specialists of the All-Union Scientific Research Institute of the Canned Goods and Dehydrated Vegetable Industry supplied a special dehydrated ration to make up for the shortage of proteins and fats of animal origin (the system is not completely closed as yet with regard to food supply).

Yu. Okladnikov, supervisor of the medical program of the experiment, is quite satisfied with the fitness and physical condition of the crew. The preliminary results of studies of physiological, biochemical and psychological functions failed to demonstrate any appreciable changes in the subjects. Their weight also remained virtually unchanged.

On 25 May the experiment was successfully completed at the exact prescribed time. Professor I. Gitel'zon, Doctor of Medical Sciences, told us about its significance:

"The studies involving 4-months in a closed 'man--higher plants' system revealed that these two elements are completely compatible. In the used mode and with the cultivation technology followed, higher plants supplied all the requirements of the crew with regard to oxygen and water. The condensate of their moisture, after additional treatment and mineralization, met in full the requirements for drinking water, as well as water for housekeeping and sanitation purposes in virtually unlimited amounts.

Another step has been made toward solving one of the main problems: reproduction of vegetables for food purposes in closed systems. They supplied about 33% of the protein and fat and over 50% of the carbohydrates in the crew's diet.

Thus, Soviet scientists have made another step toward developing effective biological systems to enable man to spend long periods of time in space. However, these studies are of major practical significance to problems on earth, related for example to environmental protection. They open the way toward development of waste-free industrial enterprises, closed systems of circulation of drinking and recycled water, many substances and elements. Such systems may find application in underground and underwater installations and reclamation of northern regions of our country.

## PHYSIOLOGY

### BRIEFS

ADAPTATION TO COLD AND ALTITUDE--Psychological problems encountered in adaptation of humans to high mountain altitudes were studied in Kirgiz by an expedition from the Arctic and Antarctic Scientific Research Institute, Academy of Sciences SSSR, Leningrad. Studies were conducted at hydrometeorological stations in Tyan-Shan' and Chaar-Tash, located at altitudes of 2700 and 3614 meters, respectively. The group, consisting of a psychologist and psychoneurologist, headed by Doctor of Medical Sciences I. F. Ryabinin, conducted detailed studies on stationed polar researchers. Accumulated data was processed on a computer in Leningrad. Ryabinin, a veteran of two winters in the Antarctic, has been researching the problem of man's adaptation to these conditions. Together with his colleagues, he visited stationed polar researchers Pevek, Dickson and Amderm in the mountains of Tadzhikistan and Uzbekistan. [Text]  
[Moscow MEDITSINSKAYA GAZETA in Russian 13 May 77 p 4]

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UDC 616-053-082.4

AGE STRUCTURE OF RURAL PATIENTS HOSPITALIZED IN CITY HOSPITALS

Moscow ZDRAVOOKHRANENIYE ROSSIYSKOY FEDERATSII in Russian No 3, 1977 pp 4-8

[Article by V.M. Shipova, candidate of medical sciences, of the All-Union Scientific-Research Institute of Social Hygiene and Health Care Organization imeni N.A. Semashko: "Special Features of the Age Structure of Patients from Rural Localities Hospitalized in City Hospitals"]

[Text] An increase in the volume of medical aid to rural inhabitants, especially in its specialized and narrowly specialized forms, constitutes an important factor in the satisfaction of the growing need of the rural population for highly skilled medical aid. This question was investigated in 10 cities of Rostovskaya, Kurskaya and Ul'yanovskaya oblasts. The volume of research involved about 40,000 cards filled out for rural inhabitants who had obtained hospital treatment in cities in the course of the year.

Rural inhabitants were hospitalized not only in oblast and rayon centers of rural regions but also in other cities where adequately large hospital-type medical institutions are to be found.

The study established that the level of hospitalization of rural inhabitants in oblast centers fluctuates, depending on local conditions, from 8.3 to 20.5 cases per 1,000 rural inhabitants of the oblast, in cities of oblast subordination--from 11 to 59.2 and in rayon centers--from 75.9 to 105.2.

In the planning of hospital aid to rural inhabitants in cities, not only the general level of hospitalization of the rural population is of importance but also the age structure of hospitalized patients, which exerts a significant influence on the structure of the bed fund and the need for physicians of different specialties. In this connection the need arises for for a deeper study of this aspect of hospitalization.

Figure 1 shows the age indicators of the level of hospitalization of rural inhabitants in a city of oblast subordination (curve 4), in a rayon center (5) and in three oblast centers: Kursk (2), Ul'yanovsk (3) and Rostov-na-Donu (1).

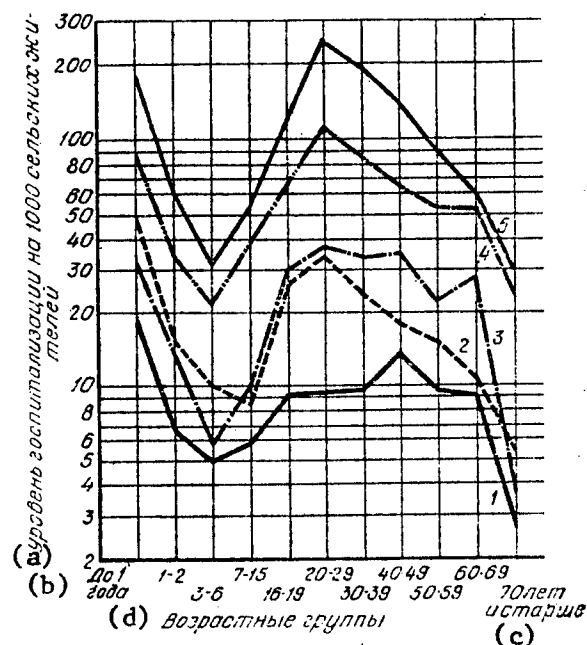


Fig. 1. Age indicators of hospitalization of rural population in cities of different type (polylogarithmic coordinate grid).

Here and on Fig. 2, 1-3 designate oblast centers, 4--city of oblast subordination, 5--rayon center.

Key:

- (a)--Level of hospitalization per 1,000 inhabitants
- (b)--up to 1 year of age
- (c)--70 and older
- (d)--Age groups

For graphic depiction, the polylogarithmic coordinate grid with a logarithmic scale on the ordinate axis was used. Such a representation is advantageous in connection with the fact that, with such significant fluctuations in the general level of hospitalization of the rural population in the studied cities --from 8.3 in one of the oblast centers to 105.2 cases of hospitalization per 1,000 rural inhabitants in a rayon center--, the use of the usual arithmetic coordinate grid impairs the comparability of changes in relative indicators (Fig. 2). The lines depicting lower indicators, in the given case the level of hospitalization of the rural population in oblast centers, in this figure are flatter than lines characterizing higher indicators of hospitalization of the rural population in cities of other types. This creates the wrong impression that among rural inhabitants treated in hospitals of oblast centers changes in the level of hospitalization depending on age are not so marked as in cities of other types. In fact this is not so. For example, the level of hospitalization of children up to one year of age in a rayon center comprises 177.1 cases of hospitalization, from 1-2 years of age--66.0, but in Rostov-na-Donu the figures are 17.9 and 6.9 cases per 1,000 children of corresponding age, that is, in both cities children from rural localities of infant age

are hospitalized three times as often as for the subsequent age group. With the use of the arithmetic coordinate gride in Fig. 2, the intensity of these changes in a rayon center is expressed significantly more than in Rostov-na-Donu, which does not correspond to reality. These changes became commensurable with the use of the polylogarithmic coordinate grid in Fig. 1. Here the lines characterizing changes in the frequency of hospitalization of infants in arms and 1-2 years of age in these cities, parallel each other.

The curves in Fig. 1 show convincingly that the most frequent hospitalization of infants in arms among rural inhabitants receiving hospital treatment in cities is characteristic of all types of cities. Children of 1-2 and 3-6 years of age are hospitalized considerably less frequently. The slight rise of indicators of hospitalization for children 7-15 years of age is replaced by a marked increase among juveniles.

The rural population of 20-29 years of age receives hospital aid in cities of different type just as frequently as children up to one year of age. The curves reflecting age changes in indicators of hospitalization of rural inhabitants have here a second (after infants) maximum rise.

The only exception is the hospitalization of rural inhabitants in Rostov-na-Donu. The rise in the level of hospitalization during the ages of 20-29 is usually connected to women receiving hospitalization for reasons of birth, abortions, pregnancy complications. About half of all patients of this age treated in hospitals of the cities of Ul'yanovsk and Kursk were hospitalized for the aforementioned reasons. In Rostov-na-Donu this indicator is less than 1/5. In our opinion, a marked rise in the level of hospitalization for this age group among rural inhabitants receiving hospitalization in oblast centers should not occur because wide-scale hospitalization in connection with these physiological conditions ought to be performed locally. Only in aggravated cases requiring highly skilled specialized medical aid should there be used hospitals of oblast centers as in the case of Rostov-na-Donu. Consequently, a rise in the level of hospitalization of this age group among rural inhabitants receiving hospital treatment in oblast centers indicates a nonrational use by rural inhabitants of the bed fund in these cities.

In subsequent age group there takes place a gradual lowering of hospitalization indicators. They are lowest in the age group of 70 years of age and older.

The range of diseases for which rural inhabitants of different ages have been hospitalized in cities depends to a significant degree on the type of city and specialization of its bed fund.

This can be seen graphically in the example of comparing the make-up of patients from rural localities hospitalized in hospitals of oblast and rayon centers of one of the base oblasts (Table 1). A comparison of intensive indicators of hospitalization of the rural population for individual ailments in this case would not be convincing in view of the significant difference in the general level of hospitalization of the rural population in these cities--from 20.5 cases per 1,000 rural inhabitants in an oblast center to 75.9 in a rayon center.

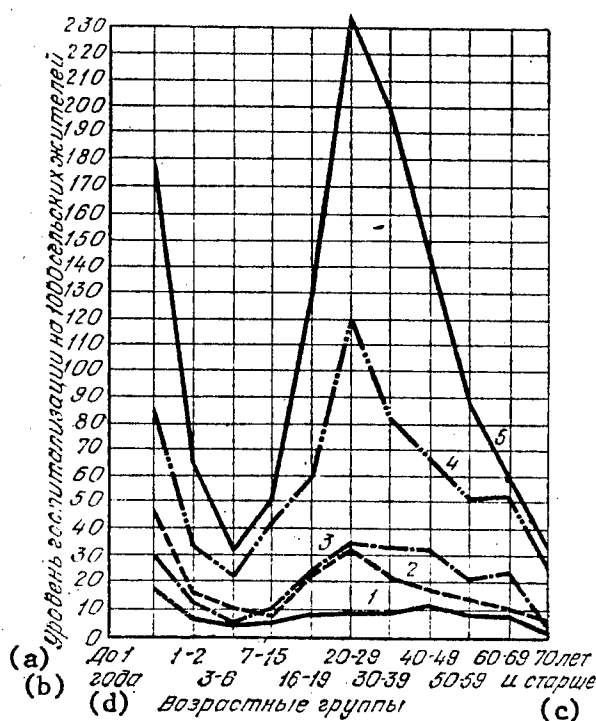


Fig. 2. Age indicators of hospitalization of rural population in cities of different type (arithmetic coordinate grid).

Key:

- (a)--Level of hospitalization per 1,000 inhabitants
- (b)--up to 1 year of age
- (c)--70 and older
- (d)--Age groups

The principal reasons for hospitalization of children from rural localities in hospitals of cities are the following: diseases of organs of respiration, digestion, infectious and parasitic diseases, accidents, poisoning and traumas. A total of 62.2 percent of children from rural localities were treated in hospitals of an oblast center and 78.8 percent in hospitals of a rayon center for these ailments. They are hospitalized in hospitals of an oblast center comparatively more frequently than in hospitals of a rayon center in connection with neoplasms, that is, ailments requiring specialized medical aid. Every tenth one from among children from rural localities hospitalized in hospitals of an oblast center is treated for ailments of the nervous system and sense organs.

A difference in the make-up of hospitalized rural inhabitants by type of cities is noticeable even among juveniles.

Table 1. Make-Up of Hospitalized Rural Inhabitants of Different Ages by Classes of Diseases

Класс заболеваний (1)	(2) Дети (до 14 лет)		(5) Подростки (15—19 лет)		(8) Взрослые (20 лет и старше)	
	(3) областной центр	(4) районный центр	(6) областной центр	(7) районный центр	(9) областной центр	(10) районный центр
(11) Инфекционные и паразитарные заболевания	11,8	12,0	11,3	5,8	6,6	4,5
(12) Новообразования	3,5	0,2	1,0	1,2	13,0	2,5
(13) Болезни эндокринной системы, расстройства питания и нарушения обмена веществ	1,8	1,8	3,6	1,9	3,1	2,2
(14) Болезни крови и кроветворных органов	3,7	1,1	0,5	—	0,8	0,1
(15) Психические расстройства	2,1	0,2	16,4	4,3	15,5	0,7
(16) Болезни нервной системы и органов чувств	10,0	4,3	6,2	4,6	9,6	4,5
(17) Болезни системы кровообращения	4,2	4,5	3,1	11,6	3,9	7,4
(18) Болезни органов дыхания	32,7	42,7	14,9	9,3	4,3	7,6
(19) Болезни органов пищеварения	9,3	20,3	8,7	21,2	8,1	14,5
(20) Болезни мочеполовых органов	2,5	2,5	2,6	2,7	5,6	9,1
(21) Осложнения беременности, родов и послеродового периода	—	—	11,3	22,4	19,9	40,9
(22) Болезни кожи и подкожной клетчатки	2,5	3,0	—	1,2	1,9	0,9
(23) Болезни костно-мышечной системы и соединительной ткани	1,8	1,6	1,0	1,9	2,4	1,7
(24) Врожденные аномалии	2,5	—	0,5	—	0,1	—
(25) Некоторые причины перинатальной заболеваемости и смертности	2,5	0,8	—	—	—	—
(26) Симптомы и неточно обозначенные состояния	0,7	1,2	9,2	4,6	0,4	0,4
(27) Несчастные случаи, отравления и травмы	8,4	3,8	9,7	7,3	4,7	3,0
(28) Всего . . .	100,0	100,0	100,0	100,0	100,0	100,0

Key:

- |  |   |
|--|---|
| (1) Class of diseases  | (21) Complications of pregnancy, labor & postpartum period  |
| (2) Children (up to 14 years of age)                                   | (22) Diseases of skin and subcutaneous tissue               |
| (3) oblast center  | (23) Diseases of musculoskeletal system & connective tissue |
| (4) rayon center   | (24) Congenital anomalies                                   |
| (5) Juveniles (15—19 years of age)                                     | (25) Certain causes of perinatal morbidity & mortality      |
| (6) oblast center  | (26) Symptoms & imprecisely characterized conditions        |
| (7) rayon center   | (27) Accidents, poisoning & traumas                         |
| (8) Adults (20 yrs of age & older)                                     | (28) Total  |
| (9) oblast center  |   |
| (10) rayon center  |   |
| (11) Infectious & parasitic diseases                                   |   |
| (12) Neoplasms   |   |
| (13) Diseases of endocrine system, disorders of nutrition & metabolism |   |
| (14) Diseases of blood & hematopoietic organs                          |   |
| (15) Mental disorders  |   |
| (16) Diseases of nervous system & sense organs                         |   |
| (17) Diseases of circulatory system                                    |   |
| (18) Diseases of respiratory organs                                    |   |
| (19) Diseases of digestive organs                                      |   |
| (20) Diseases of genitourinary organs                                  |   |

Table 2. Reference Indicator of Number of Beds Used by Rural Population of Different Age Groups in Cities (per 1,000 Rural Inhabitants According to Age)

Тип города (1)	(2) Общее число коек		(5) Возрастная группа, лет											(6)
	(3) обычный по казатель	(4) стандартизо- ванный по ка- затель												
			до 1	1—2	3—6	7—15	16—19	20—29	30—39	40—49	50—59	60—69	70 и старше	
(7) Областной центр	1,4	1,5	2,6	1,0 <sup>3</sup>	1,0	0,7	1,9	2,5	2,4	2,2	1,5	1,1	0,5	
(8) Город областного подчинения	2,4	2,3	3,5	1,0	0,9	1,6	2,4	3,1	2,6	3,0	2,3	3,2	1,9	
(9) Районный центр	5,2	5,4	7,3	3,4	2,0	2,7	5,9	7,0	8,6	8,7	6,6	4,4	1,8	

Key:

- (1) Type of city
- (2) Total number of beds
- (3) customary indicator
- (4) standardized indicator
- (5) Age group, years
- (6) 70 and older
- (7) Oblast center
- (8) City of oblast subordination
- (9) Rayon center

The specialized medical aid received by rural inhabitants primarily in an oblast center as opposed to a rayon center is displayed most clearly among the adult population. Complications of pregnancy, labor and postpartum period serve as the principal reason for hospitalization of the adult population in hospitals of cities. But whereas every fifth adult rural inhabitant is hospitalized in oblast-center hospitals for this reason, more than 40 percent of them are included in the structure of those hospitalized in hospitals of a rayon center for physiological conditions or deviations from them. The complex treatment of patients with neoplasms (chemotherapeutic, surgical, radiation) requires the organization of specialized departments, the presence of proper equipment and the like. The absence of necessary conditions for rendering medical aid at the contemporary level to oncological patients in a rayon center results in an increase in the volume of medical aid to these patients in the oblast center. Oncological diseases comprise 13 percent among rural inhabitants over 20 years of age treated in oblast-center hospitals and only 2.5 percent of those hospitalized in a rayon center.

Thus the basic reason for the hospitalization of patients from rural localities in oblast-center hospital is the desire to receive highly skilled medical aid. At the same time, a significant proportion of children from rural localities receiving treatment at an oblast center consist of patients who could have been treated locally with pediatric aid adequately developed there. The strengthening of pediatric service in rural localities, and especially in central rayon hospitals, would bring medical aid closer and reduce significantly the frequency of hospitalization of children from rural localities in oblast-center hospitals.

An important indicator characterizing hospital aid to the population is the average duration of hospital treatment. At oblast-center hospitals, rural inhabitants are treated longer (24.7-31.5 days) than in hospitals of cities of other types (9.9-16.5 days). This is due to the fact that rural inhabitants come to medical institutions of oblast centers with more severe and complex ailments requiring highly skilled specialized medical aid.

Computation of the number of beds for the rural population of different age groups in different types of cities shows that the biggest number of beds is used babies and rural inhabitants 20-49 years of age (Table 2).

The age structure of the rural population has been used as a standard.

The smallest number of beds in cities is used by rural inhabitants 3-6 and older than 70 years of age. In other words, the tendency for change of this indicator is extremely close to changes in the age level of hospitalization of rural inhabitants in these cities but flatter in view of the aforesaid feedback between the level of hospitalization and average duration of hospital treatment--the two magnitudes appearing as factors in the formula for computing the number of beds.

Standardization of the total number of beds in different cities did not change significantly the swing of the fluctuations of this indicator, since no sharp differences existed in the given case in the age structure of the rural population.

The determination of such a large difference in the number of beds occupied by the rural population in cities depending on age shows the impossibility of using in the planning of health care just the general indicator of the number of beds for the entire rural population without consideration of the varying degree of use of the bed fund of cities by the rural population of different age groups.

Thus in the planning of hospital aid to rural inhabitants in cities there should be taken into account the special features of the volume, level and character of this aid connected to the age structure of those hospitalized.

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## VETERINARY MEDICINE

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### ZOOHYGIENIC REQUIREMENTS FOR PLANNING AND DESIGNING INDUSTRIAL TYPE FARMS

Moscow VETERINARIYA in Russian No 3, 1977 pp 49-52

[Article by G. K. Volkov and V. I. Bol'shakov, All-Union Scientific Research Institute of Veterinary Sanitation]

[Text] At the present time, the development of planning assignments and blueprints of livestock farms and complexes is done, chiefly, by planning organizations in the system of Glavsel'stroyproyekt [Main Administration for the Planning of Rural Buildings and Structures at the State Committee for Construction, USSR] of the USSR Ministry of Agriculture, as well as by other organizations which do not specialize in the planning of livestock structures and do such jobs on the instructions of local agencies. As a result of this, zoohygienic requirements are often not fully taken into consideration and the blueprints and specifications are not up to standards. Consequently, some livestock barns do not meet the requirements necessary for obtaining high-quality products from the animals.

It becomes necessary for the veterinarian to examine, study, and analyze planning proposals, planning assignments, as well as the blueprints for the construction of industrial-type farms submitted for coordination and approval. Special requirements must be imposed on experimental and standard designs for the construction of farms and complexes.

Plans for industrial-type farms and complexes must be appraised on the basis of the "Instructions on the Procedures of Veterinary Appraisal of Specifications for the Construction and Reconstruction of Livestock Farms and Enterprises Engaged in the Production of Milk, Meat, and Eggs on an Industrial Basis and on the Veterinary and Sanitation Requirements for Their Construction," approved by GUV [main veterinary administration] of the USSR Ministry of Agriculture and coordinated with "Glavsel'stroyproyekt" on 27 May 1974 (Kolos Publishing House, 1975).

It is necessary to fulfill Item 3 of Section II of the "Veterinary Regulations of the USSR" which states: "Chief state veterinary inspectors and their deputies and state veterinary inspectors have the right: to halt the construction and reconstruction of production buildings and structures and the



delivery of newly constructed, restored, or reconstructed facilities on livestock farms if zoohygienic norms and veterinary and sanitation rules are not observed until such violations are removed..."

Veterinary specialists engaged in production encounter, for the most part, plans for industrial-type farms which have already been prepared. In this case, they must be able to select a plan which, first of all, would suit the local conditions. In analyzing the plan (on which the observance of zoohygienic norms for livestock maintenance depends greatly), veterinary specialists must pay attention to the housing system for the livestock, familiarize themselves with the insulation of outer protective structural components of buildings (walls, floors, coverings) and the method of feeding the animals provided for in the plan; ascertain whether or not the plan conforms to the feed resources of the farm and the possibilities of selling its products; check the norms for the housing of the livestock and the lighting system proposed in the plan; familiarize themselves with the ventilation and sewerage systems given in the plan, quality of floors, etc.

Veterinary specialists must be fully aware of the entire technology of housing, feeding and watering the animals presented in the plan. By studying the plan, it is possible to reveal and remove the defects, and organize proper operation of the farms in the future. If a given plan does not conform to the climatic zone in which the farm is situated or does not correspond to the norms and requirements, veterinary specialists have the right to advise the administration of the farm to replace this plan with another one or to propose measures for improving it. It is necessary to discuss and analyze plans for industrial-type farms jointly with the participation of engineers, agriculturists, livestock experts, and farm economists.

Knowledge of zoohygienic norms and rules and their correct application is the basis for avoiding gross errors in the planning and construction of industrial-type farms and complexes.

Zoohygienic requirements for the planning of industrial-type farms are stated in the Technological Planning Norms for farms by species of animals and poultry: horned cattle (NTP-SKh [technological planning norms-agricultural] 1-72), pig breeding (NTP-SKh.00-74), sheep breeding (NTP-SKh.5-68+ -- with consideration for introduced modifications), horse breeding (NTP-SKh.9-66+ -- with consideration for introduced modifications), fur farming and rabbit breeding (NTP-SKh.3-71), poultry farms and poultry plants (NTP-SKh.4-72).

The Technological Planning Norms define: animal housing systems, sizes and structures of herds; nomenclature of buildings and structures; the make-up of premises and technological requirements for them; norms for areas and dimensions of the main technological elements of buildings, structures, and rooms; approximate norms for the needs and stock of feed and bedding; norms for the needs in water and requirements for water supply; norms for the yield of manure and sewerage requirements for farms; norms for heat, gases, and water vapor yield by animals; norms for the parameters of indoor air (microclimate within structures), and requirements for the heating and

ventilation of buildings; norms for natural and artificial lighting in buildings; technological equipment and mechanization of production processes.

Plans for industrial-type farms must have provisions for measures for protecting buildings from mouselike rodents in accordance with the "Provisional Recommendations for the Protection of Light Structures Against Mouselike Rodents with the Use of Organic Materials in Agricultural Buildings and Structures" (approved by "Glavsel'stroypromekt" of the USSR Ministry of Agriculture 13 May 1971).

In order to ensure optimal microclimate in livestock buildings, special attention must be given to the insulation of outer protective structures of building (walls, covering, floors, and ceilings). In order to prevent the formation of the condensate of water vapor constantly present in livestock buildings and to minimize the loss of heat from the buildings, it is necessary to require that the workers of design institutes should make them as heat-transfer-resistant as possible.

For a rated external temperature of minus 30 degrees during the winter period, it must be not any less than 1.6-2.2 meters<sup>2</sup>·hr·degree C/kcal for the walls and 2.3-3.8 for coverings and floors and ceilings. In the climatic zones of the country with lower rated temperatures, it must be higher. Unfortunately, in the majority of the existing standard and experimental projects of industrial-type farms these requirements are not fulfilled. This results in the creation of unsatisfactory microclimates in buildings.

The sanitation norms for the planning of industrial enterprises (SN-245-71) provide for sanitary protective zones (areas between the areas where industrial harmful substances are ejected into the environment and areas with inhabited public buildings) of 300 m; minimum distances between various types of farms are stated in the Technological Planning Norms by species of animals and poultry.

Experience in operating large farms in our country and abroad, particularly pig-breeding farms, shows that, when the animals are kept in barns with open manure pits, large complexes must be at least 3 km away from populated areas, and when animals are kept in open areas, at least 5 km away. Distances between individual barns for the animals must be in accordance with the fire prevention requirements.

However, it should be mentioned that in this case there is a danger of aerogenic spread of contaminated air from one barn to another. In order to prevent this danger, it is necessary to block individual barns by installing special devices (shields) on the air ducts of exhaust fans which would direct the stream of the exhaust air downward (toward the ground); to have a centralized system for ejecting contaminated air upward in order to create an "aerodynamic shadow", for which the height of the pipes of the exhaust ventilation system must be at least 3-8 m.

The problems of creating optimal conditions for keeping the animals are of great importance. As has already been mentioned, the sizes of areas for housing the animals are given in the Technical Planning Norms by species of animals and poultry. These norms are often not observed, and large numbers of animals are concentrated in one barn. For example, in recent years the housing area for young fattening horned cattle has decreased from 6.7 to 1.8 m<sup>2</sup>, for pigs -- from 1.8 to 0.5-0.3 m<sup>2</sup>, and the poultry housing density increased by four times.

In connection with the construction of slatted floors and the use of lattices on the part of the solid floor, the length of the solid floor in the stalls and boxes for cows has been decreasing, while the slatted part has been increasing. In some designs of milk farms, the length of the solid floor is from 1.2 to 1.35 m. We believe (and this should be required from the designers) that the length of the solid floor in a box or a stall for cows must be at least 1.6 m, in the delivery section and in the hospital for sick animals -- 1.8 m, and in dispensaries for milk-fed calves -- 60 cm (better heated). Solid floors answer the physiological needs of the animals best; their thermal activity index must not exceed 10 kcal/m<sup>2</sup>.1/2 degree C, and for growing and fattening cattle -- 13 kcal/m<sup>2</sup>.1/2 degree C.

At the present time, slatted, slotted, and perforated floors are used widely in barns. However, it is necessary to mention that their wrong design, type sizes, and structural imperfection result in ailments of the extremities and utters of animals, as well as contribute to colds.

In order to prevent traumatism of animals kept on slotted and slatted floors at milk farms and industrial complexes producing beef, the cross section of the elements of slatted floors must be of strictly trapezoidal or triangular shape without additional tapering or rounding. The dimensions of the upper edge and the slot must be designed with consideration for the age of the animal: up to three months, the width of the upper edge must be 50 mm, and the width of the slot 30 mm; from three to six months -- 80-100 and 35-40 mm respectively; from six months and older -- not less than 100-120 and 40-45 mm for reinforced concrete floors. For cast iron floors (produced by the industry), the width of the strip -- 30 mm and the width of the slot 25 mm; for steel floors -- 20 and 20 mm respectively. When pigs are kept on slotted floors, the width of the slot must be not more than 22 mm, and the width of the strip 35 mm.

In creating an optimal microclimate, an important role is played by the planning of the cubic volume of farm buildings and their cubic capacity per one animal (specific cubic capacity). We recommend specific cubic capacity: for cows -- not less than 30 m<sup>3</sup>, for young horned cattle -- 15, pigs -- 20-25, sheep -- 6-10 m<sup>3</sup> at the expense of increasing the height of the building.

Zoohygienic requirements for the methods of removing manure from barns are explained in the "Technological Planning Norms for Systems for Removing, Processing, and Decontamination of Manure."

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LENGTH OF PERSISTENCE OF A VACCINE STRAIN OF AUJESZKY'S DISEASE IN THE ORGANISMS OF YOUNG PIGS

Moscow VETERINARIYA in Russian No 3, 1977 pp 57-59

[Article by V. G. Vitin, V. I. Popov, and D. A. Petrachev, All-Union Scientific Research Institute of Veterinary Virology and Microbiology]

[Text] The purpose of this work was to study the immunological reactivity of young pigs to the administration of virus vaccine against the Aujeszky's disease during the early postnatal period (first hours of life) and the distribution of the vaccine virus in their organs.

The experiments were conducted on newborn gnotobiotic pigs, as well as on young pigs obtained from mothers immune and nonimmune to the Aujeszky's disease.

The vaccine (attenuated strain BUK-630 of the Aujeszky's disease virus) in the form of a cultural virus-containing fluid of serial passage in a culture of chicken embryo cells (KKE) was introduced to the pigs immediately after their birth intramuscularly or perorally in doses of  $3 \times 10^6$  and  $5 \times 10^6$  TTsD [expansion unknown] ml, respectively. The vaccine was not administered to the control pigs.

The virus-specific antigen in the organs of pigs killed at different times after vaccination was revealed by the direct method of fluorescent antibodies (MFA), by isolating the virus in a KKE culture infected with a suspension of the organs of the pigs, and by infecting rabbits. Morphological changes in the lymphoid organs of the vaccinated animals were studied in sections of tissues stained by the Brachet method.

For the control infection, we used virulent strain P of the VBA [virus of the Aujeszky's disease], which was introduced into the brain in a dose of  $0.2 \times 10^{6.75}$  TTsD<sub>50</sub>/ml 30 days after a single vaccination.

In selecting the dose of the attenuated VBA strain not causing clinically expressed postvaccinal complications, doses from  $1 \times 10^6$  to  $5 \times 10^7$  TTsD<sub>50</sub>/ml were tested.

The introduction of massive doses ( $3 \times 10^7$  -  $5 \times 10^7$  TTsD<sub>50</sub>/ml) of the VBA vaccine strain to young gnotobiotic pigs and those kept under a nonimmune mother immediately after their birth caused their death. The VBA was isolated from all organs of animals which died or were killed in the agonal state. The administration of doses of  $3 \times 10^6$  -  $5 \times 10^6$  TTsD<sub>50</sub>/ml was accompanied by the distribution of VBA in the organs of the gnotobiotic pigs and a marked immune reaction without causing the death of the pigs or clinically expressed postvaccinal complications. In this case, on the 30th day after vaccination, virus-neutralizing antibodies were found in the blood serums of the pigs in a relatively high titer (1:128), which ensured a high degree of resistance of the pigs to the control infection of the brain with a virulent strain of the VBA.

When doses of  $1 \times 10^6$  -  $2 \times 10^6$  TTsD<sub>50</sub>/ml were administered, the virus was isolated only from the blood, the lymph node in the region of the administration, as well as from the liver and the kidneys.

Analysis of the accumulation of virus-neutralizing antibodies showed that the doses of the attenuated strain of the VBA of  $3 \times 10^6$  TTsD<sub>50</sub>/ml after intramuscular administration and  $5 \times 10^6$  TTsD<sub>50</sub>/ml after peroral administration had identical antigenic effect on the organism.

The virus of the Aujeszky's disease was isolated on a KKE culture from the blood of the pigs after six hours. With both methods of vaccination, it circulated in the blood in the course of 120-144 hours after vaccination. Its maximum amount (4-5 lg TTsD<sub>50</sub>/ml) was detected 48-96 hours after administration.

There was no substantial difference in the distribution of the VBA and in the level of its accumulation in the organs after the intramuscular and peroral administration. The virus was isolated in a considerably higher titers in comparison with other organs from the lung and kidney tissues. Some untitratable amount of it which was detected by the cytopathogenic effect in a KKE culture was retained in these organs up to 5-6 days. During the same period, the virus was isolated in relatively high titers from the tissues of regional lymph nodes -- submaxillary and retropharyngeal after the peroral administration, and the left inguinal lymph node after the intramuscular administration (Table)

After peroral administration, the virus was detected in the tonsils regularly during longer periods then after intramuscular administration.

After peroral administration, the VBA was accumulated in mesenteric lymph nodes in a somewhat higher titer then after intramuscular administration. The virus was detected regularly in the liver during the first two-three days. The virus was never isolated from the heart and brain tissues.

Rabbits infected with a ten-percent suspension of pig organs died in 100 percent of cases 72-96 hours later.

Ткань (1)		(14) Титр ВБА в органах (lg TЦД 50/мл)					
		(15) перорально			(16) внутримышечно		
		24 ч	72 ч	144 ч	24 ч	72 ч	144 ч
(2) Регионарный лимфоузел	(3)	—	1.5 ± 0.50	—	4.5 ± 0.91	5.5 ± 0.91	—
Отдаленный лимфоузел		—	1.5 ± 0.76	—	—	2.0 ± 0.76	—
(4) Легкие		3.25 ± 0.80	6.0 ± 0.91	5.5 ± 0.91	3.75 ± 1.04	6.0 ± 0.91	5.0 ± 0.70
Почки (5)		3.0 ± 0.73	5.0 ± 0.57	1.0	3.0 ± 0.91	5.25 ± 0.76	1.0
(6) Печень		1.0	2.25 ± 0.76	—	1.0	2.0 ± 0.76	—
Сердце (7)		—	—	—	—	—	—
(8) Кровь		2.5 ± 0.76	4.25 ± 0.76	—	2.0 ± 0.76	5.0 ± 0.91	1.0
Головной мозг (9)		—	—	—	—	—	—
(10) Лимфоузлы брюшной		5.0 ± 0.75	5.25 ± 0.76	3.0 ± 0.76	—	3.25 ± 0.76	—
Миндалины (11)		3.75 ± 0.73	4.5 ± 0.81	3.0 ± 0.78	—	2.25 ± 0.50	—
(12) Лимфоузлы слоточного кольца		2.5 ± 0.76	4.0 ± 0.91	1.0	—	1.75 ± 0.50	—
Селезенка (13)		—	3.0 ± 0.57	—	1.0	3.25 ± 0.76	—

Key: 1. Tissue 7. Heart  
2. Regional lymph node 8. Blood  
3. Remote lymph node 9. Brain  
4. Lungs 10. Mesenteric lymph nodes  
5. Kidneys 11. Tonsils  
6. Liver 12. Lymph nodes of the throat ring  
13. Spleen  
14. VBA titer in the organ (lg TTsD<sub>50</sub>/ml)  
15. Peroral  
16. Intramuscular 17. Hours

After intramuscular administration, the virus antigen was detected 48 hours later in smear prints from regional lymph nodes, liver, kidneys, spleen, and lungs, and after 72 hours it was also found in the tonsils and mesenteric lymph nodes. After 96 hours, specific luminescence was detected irregularly in the liver, spleen, and tonsils, however, it was found constantly in the kidneys, lungs, and mesenteric and regional lymph nodes.

After peroral vaccination, the VBA was detected by the method of fluorescent antibodies also 48 hours later primarily in the tonsils, lymph nodes of the throat ring and mesenteric lymph nodes, as well as in the liver, lungs, and

kidneys; 96 hours later, it was found in all organs including remote lymph nodes as regularly as after intramuscular administration. On the sixth day after oral administration of the VBA, specific luminescence was found only in the lungs.

We were unable to establish any clear relationship between the predominant multiplication of the virus in the organs and the morphological or functional type of cell. According to the data of luminescence microscopy, the VBA multiply predominantly in the parenchyma cells regardless of their morphological and functional organization. As a rule, the virus-specific antigen was localized in the cell nuclei.

On the fourth day after vaccination, necrosis foci were found in the regional lymph node of the place of administration by histomorphological studies. They increased in size on the fifth-sixth day. Necrosis foci were found in the cortical layer of the adrenal glands and liver. By this time, a well marked lymphoid reaction developed in the spleen.

Ten, and in some cases 15, days after vaccination, by the method of fluorescent antibodies, the virus-specific antigen was found only in the lungs. In one case out three, specific luminescence was found in smear prints from the brain after 27 days, while no virus-specific antigen was revealed in other organs. Probably, the VBA does not multiply in all sections of the brain (M. G. Nikitin, P. M. Bazylev, 1967) or it appears in the brain later than in other organs (N. S. Bukina, 1967). The antigen was not detected in any of the studied organs 49 days after vaccination, although, according to some researchers (Kh. Genov et al, 1972, Gustafson et al, 1972), the virus of the Aujeszky's disease circulates in the organisms of young pigs for a considerably longer time.

The distribution of the VBA was the same in the organs of newborn pigs kept under a mother nonimmune to the Aujeszky's disease. It was isolated in a KKE culture from the same organs and in approximately the same titers. However, unlike the gnotobiotic pigs, the VBA was not detected in any of the studied organs 10 days after vaccination.

The colostrum antibodies in young pigs kept under an immune mother prevented the multiplication and spread of the attenuated VBA strain in the organs. In the same way, the VBA administered to the pigs again 14 days after a single vaccination was detected only in the course of 48 hours in regional lymph nodes and only after the intramuscular administration.

## Conclusions

1. The attenuated strain BUK-630 of the virus of the Aujeszky's disease administered to young pigs in a dose of  $5 \times 10^7$  TTsD<sub>50</sub>/ml immediately after birth was fatal to gnotobiotic pigs, as well as to pigs kept under a mother nonimmune to the Aujeszky's disease.

2. The dose of  $3 \times 10^6$  TTsD<sub>50</sub>/ml for intramuscular administration and  $5 \times 10^6$  TTsD<sub>50</sub>/ml for peroral vaccination of pigs immediately after their birth are the maximum possible doses which are not fatal and do not bring about clinically expressed postvaccinal complications.

3. Both the peroral and intramuscular administration of the vaccine are accompanied by the distribution of the virus in all organs of the pigs, however, in both cases the virus is localized chiefly in the lungs and kidneys.

4. Colostrum antibodies prevent the multiplication of the attenuated strain of VBA in the organs of young pigs.

5. Pigs vaccinated immediately after their birth with the attenuated strain BUK-630 in a dose of  $3 \times 10^6$  TTsD<sub>50</sub>/ml are capable of immune response and develop resistance to control infection into the brain with a virulent VBA strain in a dose of  $0.2 \times 10^{6.75}$  TTsD<sub>50</sub>/ml.

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AEROSOL VACCINATION OF POULTRY AGAINST INFECTIOUS LARYNGOTRACHEITIS

Moscow VETERINARIYA in Russian No 3, 1977 pp 67-68

[Article by V. V. Chernyshev, Yu. S. Dutko, V. I. Burtsev, G. A. Rudobel'skaya, and I. M. Bondarenko, All-Union Scientific Research Institute of Veterinary Virology and Microbiology]

[Text] The existing method of immunizing poultry against infectious laryngotracheitis (ILT) which is based on rubbing the vaccine into mucosa of the upper vault of the cloaca is labor-consuming and not very productive, because three persons are required for immunizing one chick. On large farms, it is necessary to have a large number of specialists, auxiliary personnel, and a lot of time. The stress on the birds which is unavoidable during vaccination lowers their productivity and life span. All this makes it necessary to search for more effective and productive methods of immunization.

Encouraging results have been obtained in aerosol vaccination of poultry against ILT (A. Ya. Urushadze, 1966; Yu. F. Petrov et al, 1974; Shamberg, 1970; Partsel, 1974, and others).

Our goal was to study the immunogenicity and reactogenicity of the vaccine against ILT in aerosol application, to determine the minimum and optimal immunizing doses of the biopreparation, as well as the time of the onset and length of immunity in vaccinated chicks.

The chicks were vaccinated with a dry vaccine against ILT from a strain of the TsNIIPP [Central Research Institute of the Poultry-Processing Industry] prepared by the Tabakhmel'skiy Biocombine. The infectious activity of various series of the vaccine was within the limits of  $10^{5.0} - 10^{5.5}$  EID<sub>50</sub>/ml [expansion unknown]. In checking the intensity of immunity in the chicks, we used an epizootic virus of infectious laryngotracheitis, Bogatishchevskiy strain. The biological activity of the virus was  $10^{6.0} - 10^{6.32}$  EID<sub>50</sub>/ml.

The experiments were conducted on 35-45 day old Leghorn chicks which were not vaccinated against ILT and were obtained from farms free from infectious diseases.

The chicks (20-30 in a group) were vaccinated by the aerosol method in a static chamber of about 1 m<sup>3</sup>. Different groups of birds were vaccinated with vaccines with different biological activity prepared by diluting the initial (whole) biological preparation with a suspending medium (distilled water containing 5 percent of pastuerized dry defatted milk or 10 percent of glycerin). For labeling, 0.1 percent uranin (disodium salt of fluorescein) was introduced into the prepared dilutions of the vaccine.

The vaccine was pulverized by means of pneumatic aerosol ejector generator PEGA-I which produced particles up to 12 microns in diameter. The concentration of the biological preparation in the chamber was determined by the results of fluorometric analysis of aerosol samples.

The vaccine dose in EID<sub>50</sub> aspirated by the chicks during the immunization time was calculated by multiplying the concentration of the aerosol of the biological preparation in the chamber (mg/l) by the exposure time (min), the lung volume of the chicks (l/min) and by the activity of the vaccine of the given dilution.

After immunization, each group of chicks was kept in isolated cages. The reaction of the chicks to the administration of various doses of the vaccine was evaluated by a 10-point system.

The postvaccinal reaction characterized by a slight depression without loss of appetite, ruffled feathers, occasional yawning and coughing which lasted as long as 8 (sometimes 12) days was evaluated at 2-4 points. The appearance of these signs indicated a weak reaction of the chicks to the dose of the vaccine aerosol received by them. When, along with the above mentioned signs, the vaccinated chicks showed signs of hard breathing, coughing, and decreased appetite registered in the course of 10-12 days after immunization, this was evaluated at 6 points (moderate reaction). When there was a considerable depression, absence of appetite, conjunctivitis, hard breathing with open beaks, rales, and death of 15-40 percent of the birds on the fifth-ninth day after the vaccination, the reaction was evaluated as strong (8-10 points). The point system made it possible to judge about the optimal and reactogenic doses of the vaccine aspirated by the birds.

In order to evaluate the intensity of immunity at different times after vaccination, the chicks were infected with ILT epizootic virus.

The chicks of various groups (a total of 45 birds) aspirated simultaneously from 2 to 119 EID<sub>50</sub> of the vaccine. The latter in the doses of 2.1 - 16 EID<sub>50</sub> form intense immunity in 50-75 percent of the chicks, and doses equal to 16 EID<sub>50</sub> or more ensured the resistance of 80-100 percent of birds to the infection by epizootic virus. The minimum immunization dose was 4.37±0.12 EID<sub>50</sub>.

In the chicks which received the vaccine doses above 15 EID<sub>50</sub>, postvaccinal reaction above 2-4 points were not registered. On the second-third day, some depression and periodic sneezing were observed in the birds which

disappeared after 7-8 days. The vaccine in a dose of 25 EID<sub>50</sub> caused a short time decrease in the appetite of the chicks, coughing, and sneezing. The reaction evaluated at 6 points continued for 10-12 days and was reversible. The vaccine in a dose of 30 EID<sub>50</sub> and above caused a reaction in the birds of 8-10 points.

In subsequent experiments we studied the effectiveness of two-time aerosol vaccination of birds with an interval of 15 days.

The 2-time vaccination created more intense immunity in the chicks than the 1-time vaccination (Table). The reaction after the second vaccination was weaker.

Table  
Comparative Data on the Effectiveness of One-Time  
and Two-Time Vaccination of Chicks

(1) Кратность вакцинации	(6) Число птиц	(7) Возраст птиц (дни)	(10) Дозы вакцин, аспирин- ные птицы (9) ЭИД <sub>50</sub>		(11) Заболе- ло
			мг/л	ЭИД <sub>50</sub>	
(2) Однократная	20	45	1.0	25	4
(3) Контроль (невак- цинированные)	10	45	—	—	10
(4) Повторная	20	60	2.4	36	0
(5) Контроль (невак- цинированные)	10	60	—	—	10

Key: 1. Number of vaccinations  
2. 1-time  
3. Control (not vaccinated)  
4. Second vaccination  
5. Control (not vaccinated)  
6. Number of chicks  
7. Age of chicks (days)  
8. Doses of vaccine aspirated by the chicks  
9. mg/l  
10. EID<sub>50</sub>  
11. Became sick

Virus-neutralizing antibodies were found in the sera of the chicks on the tenth day after vaccination in doses of 16 EID<sub>50</sub> and more. It was observed that there was a correlation between the appearance of virus-neutralizing antibodies in the blood serum and the resistance of the chicks to infection by virulent virus of infectious laryngotracheitis. The neutralization index in the chicks which did not get sick after the control infection was 1.5 - 2.0 lg.

We conducted experiments on the onset time and length of immunity after aerosol vaccination of 38 thirty-five days old chicks in a dose of 24 EID<sub>50</sub>.

Immunity in 50 percent of chicks vaccinated once started forming by the seventh day, and by the ninth-eleventh day they were resistant to the ILT virus in 75-100 percent of cases. Their resistance to the virulent virus continued in the course of 5-6 months (observation period).

It was established that immunity in chicks vaccinated by the cloacal method (according to present regulations) with a vaccine from the TsNIIPP strain formed somewhat later (by the 14th day after vaccination) than in chicks vaccinated by the aerosol method.

#### Conclusions

1. Both one-time and two-time aerosol administration of a vaccine from the TsNIIPP strain against ILT to 35-45-day old chicks ensures the formation of intense immunity to infection by the epizootic virus of infectious laryngo-tracheitis. The minimum immunizing dose producing resistance to the virulent ILT virus in 50 percent of vaccinated chicks is  $4.37 \pm 0.12$  EID<sub>50</sub>.
2. Vaccine doses of 16-17 EID<sub>50</sub> administered once by the aerosol method produced resistance to ILT in 80-100 percent of experimental chicks. Undesirable postvaccinal reactions were observed after a single administration of doses of 30 EID<sub>50</sub> or higher.
3. After a single vaccination of birds, resistance to infection by virulent ILT virus develops on the seventh-ninth day and continues for 5-6 months.

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